March/April 2008 >> Vol.36

AECMAGAZINE

DESIGN, MANAGEMENT & COLLABORATION IN THE BUILT ENVIRONMENT



Generative Components

Advanced form design in architecture

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Evaluating building performance with IES and Ecotect

CAD training special / Autodesk 2009 portfolio / Display Technology

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Great Building – Smart Designing

Jimbocho Theatre – six-storey, 1,428 square metre theatre and entertainment centre with an exposed concrete interior which serves to naturally cool the building.

Great building designed, in 3 months, by Tomohiko Yamanashi of Nikken Sekkei (more at www.graphisoft.com).

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Picture courtesy of Tomohiko Yamanashi (Nikken Sekkei).

AECMAGAZINE
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Vol.36: Contents

Tekla enters Russian market with software

Tekla is looking towards opportunities in Russia with the upcoming Tekla Structures 14 software version, which will include a fully localized Russian environment.

Holding their first seminar in Moscow on Tekla Structures software, more than 50 companies representing the major steel fabricators in the area participated.

The event was organized in co-operation with CNC machine manufacturer Ficep, Tekla Corporation and Tekla Structures Russian reseller VentSoft.

According to Telka's market research, Russia is a challenging market but also the one showing the strongest IT growth at the moment.

www.tekla.com

Piranesi artists given new gallery online



A new website from Informatix is showcasing the work of customers using Piranesi artist's impression software.

The central part of every page is dedicated to a customer image, with most accompanied by a short passage about the image and its creator.

Infomatrix marketing manager Jeremy Jones, says: "The real message behind the product is simple: Piranesi enables our customers to create wonderful, stylish artist's impressions of their design projects, which will genuinely wow their clients. What better way to express that than by showcasing the illustrations themselves?

"If demonstrating Piranesi's potential helps promote the individuals and firms who are submitting images, then Informatix is happy to assist."

www.informatrix.co.uk

Excitech awarded BlueCielo reseller of the year

Excitech have been named by BlueCielo as their European Reseller of the Year by Partners, at the ECM Frontiers Awards.

Martijn Janmaat, President and CEO, of BlueCielo ECM Solutions was pleased to announce the UK supplier, praising the team's skills. "This award recognises not just Excitech's best revenue performance in Europe in 2007, but also its top expertise, excellent customer service and strong skills in handling sophisticated, multi-site implementations of our leading InnoCielo engineering content management solutions," he said.

Excitech's Electronic Document Management (EDM) team offer a range of information management consultancy and solutions based on industry standard platforms and software solutions.

www.exitech.com

New thinking on latest KIP offering

In the KIP9000, KIP UK has launched their most powerful integrated production system to date.

Offering 600 x 600 DPI printing with advanced imaging algorithms for high quality reproduction, the KIP UK introduces new thinking on electronic distribution and printing at the point of use, by including its own PrintNET software as standard which can receive files electronically from anywhere via a web browser.

As with the rest of the range, the KIP9000 has an open architecture that according to KIP will be able to integrate seamlessly into existing information management systems using an application programming interface to allow users to fully integrate their new investment with any existing system.

Capable of delivering 22 A1 prints per minute, it prints from all major software packages on Windows, Linux, Mac or Unix platforms and includes native DWF batch processing for printing complex drawings.



KIP also boast an increased quality and sensitivity in both scanning and output to produce the accurate tonal gradation differentiation when printing in mono.

www.kipuk.com.

Hilton happy with BIM savings on latest project

The utilization of Building Information Modelling has been showcased in the opening of the new Aquarium Hilton Garden Inn in Atlanta, United States, saving the project more than $800,000.

Serving as the BIM creator, integrator and manager, Atlanta-based general contractor Holder Construction modelled the structure, skin, MEP systems and interior finishes in ArchiCAD, integrating with NavisWorks to enable the team to identify 590 collision conflicts.

Through frequent 3D coordination sessions, the project team revealed they were able to quickly identify and resolve field conflicts within the award-winning, $46 million project, saving more than $800,000 in extras and avoiding months of potential delays from collisions.

"The collaborative 3D sessions improved communications and trust between the various stakeholders and enabled us to make rapid changes in the early phases of the project," said Paul Hedgepath, senior BIM engineer at Holder Construction.

"The spaces they designed and approved with 2D drawings and static renderings now could be experienced in an active 3D model."

www.graphisoft.com

Bentley book place in infastructure history

The digital version of "The Year in Infrastructure 2007," Bentley's 180-page project yearbook showcasing the work of Bentley users, has been made available.

The yearbook features descriptions and colour illustrations of more than 230 recognised project nominations and 36 winners honoured in the Building, Plant, Civil, Geospatial, IT and Training, and Academic categories



of the 2007 BE Awards of Excellence program.

Jay McGraw, group publisher, McGraw-Hill Construction, which sponsors the BE Awards ceremony, said: "It provides the opportunity to learn about the accomplishments and challenges faced by some of the most innovative project teams in the world."

www.bentley.com
www.bentley.com/projectyearbook

Océ adapt printer for Mac

Océ have adapted one of their TCS500 systems to work on a Mac-based interface, the first of its kind in Southwest England for Océ and distributOr Westec.

As with the majority of professional digital printing systems on the market, the TCS500 is designed predominantly for use with a PC interface, although Océ set to work converting it on site at Poynton Bradbury Wynter Cole architects in St Ives. Océ now say that the system runs as well as it would with a PC, while also linking to CAD accounting software.

One of the largest architects' practices in the region, they had been Mac-based since the mid-1980s. The company found that finding a compatible printer was a near-impossible task. Westec sourced Océ, stating that the problem was some manufacturers' technology could potentially be converted to work, but suppliers did not have either the expertise or the desire to go down this route.

www.oce.com

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> Building Information Modelling – Architecture
> Civil Design
> Sustainability Design Solution
> 2D Manufacturing Design
> P & ID Design
> Building Information Modelling – Structures & MEP
> License & Software Asset Management
> Directors Commercial Round Table
> 3D Manufacturing Digital Prototyping

THE EVENTS WILL BE TAKING PLACE AS FOLLOWS:

30th April	LONDON - Holborn Bars
14th May	BRISTOL - Hilton
3rd June	BIRMINGHAM - The Belfry
5th June	GATWICK - Hilton



For the latest information or to register for one of our Customer Events contact:

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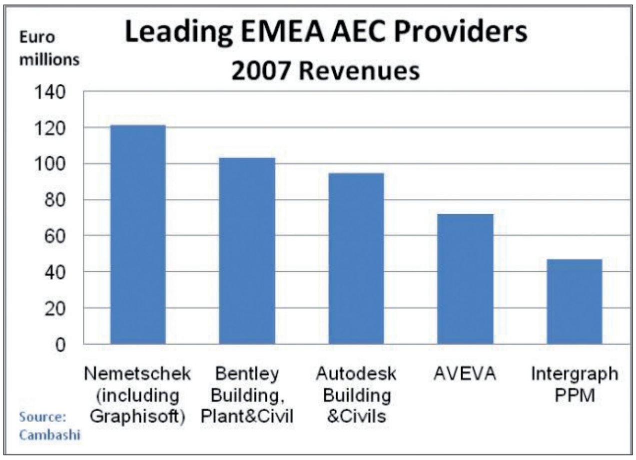
Autodesk Premier Solutions Provider Building

EMEA revenue growth looks set to continue in the next year

Last year, revenues for engineering applications software providers in the European, Middle East and African (EMEA) region grew seven per cent to nearly €30Bn, with similar growth expected in 2008.

Architecture, engineering and construction was the fastest growing and second biggest segment, increasing by 16 per cent to nearly €460m, with expected gains in the coming year of 11 per cent to around €510m.

Creators of the survey, Cambashi, believe growth is attributed to two related factors: The transition from 2D to 3D building information modelling technology, and the demand of software users for better integration of products.



Autodesk

In 2007, Autodesk's AEC software revenues, which include building and civil, but exclude the use of AutoCAD and AutoCAD LT in AEC, grew by 18 per cent to €94m. In 2008, Cambashi predicts growth of over 25 per cent to €120m.

3D products, Revit and Civil3D, with their increased focus on BIM are responsible for generating this growth. The recent acquisitions of complementary technologies, like Robobat (France) and NavisWorks (UK) is expected to lead to further growth.

Bentley

Although not directly comparable with Autodesk figures, Cambashi estimates that in 2007 Bentley generated around €103m in AEC revenues including building, civil and plant applications, forecast growth of eight per cent for this year.

Already in 2008 they have announced the acquisitions of ECT promise and Hevacomp in the UK; and LEAP Software in the USA, adding components such as electrical, and heating, ventilation and air conditioning (HVAC) to the building information modelling platform.

Nemetschek

With AEC revenues of over €121m for 2007 Nemetschek is the largest European based AEC competitor to Autodesk and Bentley. Following the acquisition of Graphisoft in 2006 and a series of niche developers in structural steel and civil engineering, revenue in EMEA grew 38 per cent in 2007. In 2008, Cambashi predicts growth of around 8%.

Aveva

Revenues grew 18 per cent to over €72m. 2008 growth is expected to be around 6 per cent as high oil price generates new investment in plant, creating demand for plant design software, as well as the acquisition of Tribon.

Intergraph PPM

Now a private company acquired by Hellman & Friedman and Texas Pacific Group in 2006, Integraph had EMEA revenues of €47m in 2007. Forecasts for 2008 show growth of around five per cent.

www.cambashi.com

New features from Bentley's ProSteel

Bentley has released Version 18 of their ProSteel application for structural engineers, fabricators and detailers of structures of all types.

The software offers powerful automated and integrated tools that Bentley claim will enhance productivity, allowing more profitability and quicker production of structural fabrication data.

Boasting a list of new features, version 18 includes new interfaces CIMSteel / CIS/2, SDNF 2 and SDNF 3, DSTV, and also supports the UCS-System of AutoCAD 2007.

In addition Bentley has made improvements that should allow individual dimensioning according to the type of object, complex and 'multilevel' dimensioning of groups, and better dimensioning of bended objects.

www.bentley.com



New 64-bit mental ray rendering software



A new renderfarm software solution for mental ray 64-bit standalone rendering software is now available from ARTVPS.

The company, known for its 3D visualisation rendering technology, has produced a Windows based application that combines mental ray rendering software with ARTVPS' own render management interface.

The company state it is fully compatible with Autodesk's 3dsmax and Maya plus Softimage XSI, and it is now possible to utilise existing hardware by installing it on any 64-bit machine running Microsoft Windows.

Graham Wylie, CEO at ARTVPS said, "ARTVPS is renowned for developing high performance rendering solutions, which not only produce great images but are also easy to use.

"Delivering a fully compatible Windows software version is an obvious next step and will appeal to 3D users wishing to add mental ray rendering to an existing rendering network or to those creating a new render farm with a preferred hardware partner."

www.artvps.com

Penguin offer cool solutions

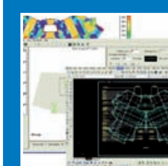
McNeel Europe has announced that the new version of Penguin is now available.

The non-photorealistic render plug-in for Rhino and AutoCAD, Penguin 2.0 boasts a host of new features including improved user interface and closer integration with Rhino, and a new shader engine that allows the combining of different shaders. Penguin are offering a free evaluation version is available for Rhino 4.0 and AutoCAD 2004-2008.

Since its first version in 2003, Penguin says it has become the preferred rendering tool for designers and architects that want to create conceptual, artistic images and technical illustrations for catalogues.

www.penguin3d.com

CADS brings in new Revit Structure solutions



International software company CADS has become an approved Revit Structure Reseller, the only UK software developer to hold this status.

Specialising in structural engineering design and detailing software, CADS have further increased their profile to include Revit Structure.

CADS Marketing Manager Gary Dale, said: "This latest development further underlines CADS role as a partner for companies looking for leading solutions that address the needs of modern building design. It also opens up a new knowledge path for owners of Revit Structure to help them exploit this powerful software and relate it directly to their project needs."

www.cadsglobal.com

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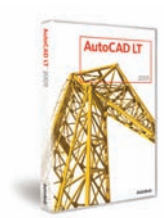
NEW!

Autodesk 2009 Product Portfolio



AutoCAD 2009

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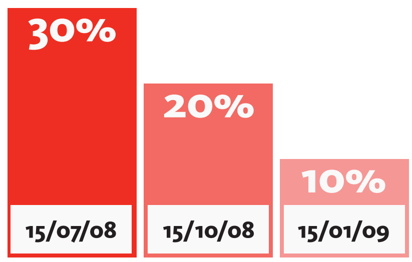


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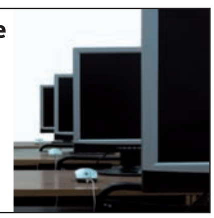
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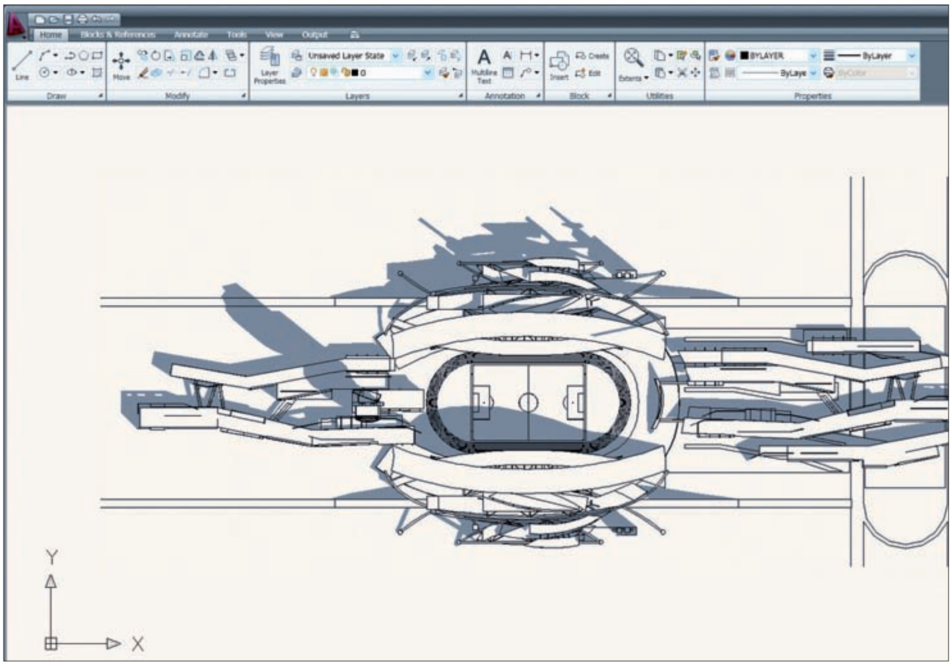
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Autodesk delivers 2009 family and previews new Viz technology



At the recent Autodesk World Press Day event in San Francisco, the company introduced its 2009 series of products which include the full AutoCAD suite, a new version of 3ds Max for design professionals, and all of the company's Revit-based Building Information Modelling tools. Autodesk also used the event to preview some brand new design visualisation technology for architects, codenamed Newport, and announce some new acquisitions in the area of sustainable design.

For AutoCAD users the big news was a new ribbon interface which enables users to view operations that are relevant to the current workspace in a single, compact place. The interface is customisable and a 'classic workspace' option still offers the more traditional toolbar and menu interface. There's also an emphasis on learning with new Tooltips, which provide more information about commands, links to help documentation and Show Me animations.

In addition to user interface enhancements, new productivity features include the Action Recorder, which further streamlines drafting tasks by allowing the user to automate them without any software programming. A mode-less layer manager lets users view changes to layer settings without exiting the Layer Manager and 3D users will find 3D navigation improvements with new ViewCube and SteeringWheels tools.

The new release also includes the addition of Impression functionality to the AutoCAD feature set, so AutoCAD subscription customers can create 'artistic' images.

2009 versions of the Industry-specific releases of AutoCAD including AutoCAD Architecture, AutoCAD Civil 3D, AutCAD Map 3D, AutoCAD MEP, AutoCAD P&ID, and AutoCAD Raster Design were also announced.

For Revit Architecture 2009 Autodesk has placed a huge emphasis on Building Performance or Green Building design. At the heart of this are closer links to partner applications including IES. However, the company also announced two acquisitions in this area, that of Carmel Software Corporation, a developer of HVAC (heating, ventilation and air conditioning) mechanical engineering software, and Green Building Studio, a provider of web-based building energy analysis that enables architects to perform whole building energy analysis early in the design process.

Elsewhere in Revit Architecture, Autodesk has enhanced the rendering functionality and swapped out the Accurender rendering engine in favour of Mental Ray, which is at the heart of 3ds Max.

Autodesk's growing commitment to design visualisation was also clear with the release of a dedicated version of 3ds Max for architects or design professionals.

Autodesk 3ds Max now comes in two distinct flavours to better meet the specific needs of our entertainment and visualisation customers," explains Marc Petit, senior VP, Autodesk Media & Entertainment. "3ds Max 2009 and 3ds Max Design 2009 provide users with tailored online experiences, user interface and application defaults, tutorials, samples, and more. This simplifies the learning process and makes it easier for users to find the information that's most relevant to them.

3ds Max Design 2009 includes all features offered in Autodesk 3ds Max 2009, with the exception of the software development toolkit (SDK). However, it also includes Exposure technology for simulating and analysing sun, sky, and artificial lighting to assist with LEED 8.1 certification.

Autodesk also showcased a brand new visualisation technology codenamed Newport, which is designed to enable architects to carry out high-quality renderings with little effort. The technology is still under development, and Autodesk stressed that it may never come to market as a product, but from the quality of the demonstrations at Autodesk University, which showed it working with Revit models effortlessly, this seems unlikely.

www.autodesk.com

Expansion sees Exactal open first London office

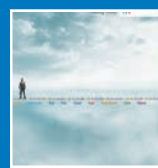
Exactal is continuing its worldwide expansion by opening its new European office in London.

As part of the expansion into Europe, the Australian software company has appointed Phil Lines as its European channels manager. Since March last year Exactal has been represented by Cadco in Ireland, with the establishment of the European office helping provide direct support to Cadco and the existing network, while extending the reseller network.

Mark Kefford, CEO of Exactal, said: "CostX is already in use by a number of international companies with offices in Europe. Establishing the new office in London for the European market will enable us to offer a wider range of support options to those companies as well as making CostX more available to the wider European market through an expanded reseller network."

www.exactal.com

Nemetshcek relaunch brand image



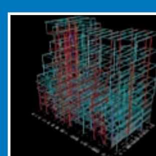
Nemetschek AG is unveiling a new corporate design, emphasising the group's position as an international vendor of AEC software technology under the slogan 'moving minds'.

A new horizon logo that "reflects the group's diversity" is also added as part of the companies umbrella branding strategy that incooporates the two subsidiaries Nemetschek Allplan and Nemetschek Scia .

Ernst Homolka, CFO and Board Spokesman for Nemetschek AG, said: "The new public image will not only create the necessary clarity for the group's broad product portfolio, it will also clearly set the group apart from its competitors."
Nemetschek has reworked its website in parallel with the new brand launch.

www.nemetschek.com

Upgraded version of RAM gets latest steel specs



Featuring the latest steel design specifications, version 11.3 of Bentley's RAM Structural System is now available.

Bentley's modelling, analysis, and design software for structural engineers involved in the design of building structures of all types has been upgraded. Bentley state that the upgraded software will provide powerful automated and integrated tools, that will "enhance structural engineers' productivity, allowing them to be more profitable and to more quickly produce economical designs."

RAM Structural System V11.3 includes several new design and usability features, including latest steel design specifications; updated design of columns, baseplates, braces, and beam web openings; and steel design tables for the U.K. have been updated to include the Corus Advance sections.

www.bentley.com

SmartGeometry Conference, Munich

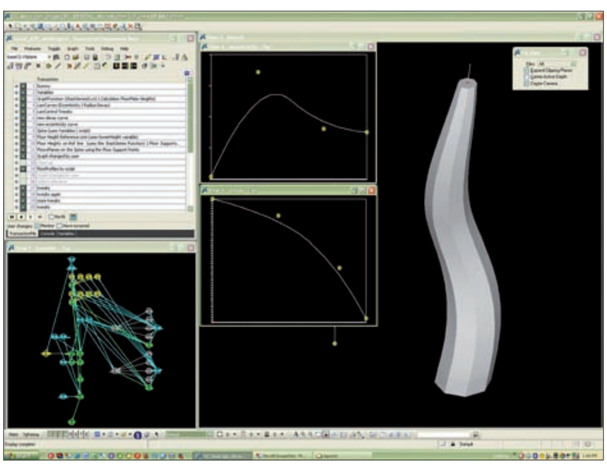
If you are into advanced form design in architecture, then you know what Generative Components is all about. Smart Geometry is the industry's leading event for advanced applicatons of computer technology. **Martyn Day** reports.

One of the Architectural highlights of the year is without doubt SmartGeometry. It's the one event where you can see totally cutting edge technologies applied to Architecture and structural design. Although these are, in the main, research projects, a handful of innovative thought leaders also present how they are using new methodologies to create some of the most radical buildings of our generation.

The founding fathers of the Smart Geometry organisation are Lars Hesselgren (KPF), Hugh Whitehead (Foster and Partners), J Parrish (Arup Sport) and Dr.Robert Aish, formerly of Bentley but now, somewhat shockingly, at Autodesk. Each event is a chance for the best students and most talented architects to come together for tuition on Bentley's parametric Generative Components technology, which was developed by Dr. Robert Aish and is based on MicroStation. Although this sounds Bentley-centric (and I guess it is), the conference element is highly non-vendor centric, and you'll see presentations on projects using technologies ranging from McNeel's Rhino to 5-axis Robots used to lay bricks!

The Autodesk shift

This was the first GC event to run since the 'father' of GC, Dr.Robert Aish, jumped sides and moved to Autodesk at the start of the year. The move shocked Bentley and many wondered what the future of GC would be. Would it continue to be developed? What would Aish do at Autodesk? It appears Bentley took this event to make a very bold statement - that GC was alive and kicking and continuing to grow in usage, despite only leaving a prolonged beta state last year. If anything, Aish's departure has forced Bentley to change down a gear and ramp up the marketing and awareness of GC in the industry, and the company looks to be more committed.



The Dubai towers under development inside MicroStation and Generative Components.

There appear to be no hard feelings between Dr.Aish and Bentley, as Aish was warmly welcomed by the Smart Geometry directors, as well as Bentley's Huw Roberts, Global Market Director for building. Aish stayed for the duration, listening intently to all the presentations but could not be drawn into a discussion as to what he would develop at his new masters, Autodesk. It would be foolish to not introduce some conjecture on this particular point, as Autodesk hired him on the basis of what they saw with Generative Components. Parametric form generation is absolutely catching on at leading practices and Autodesk realises that it doesn't have anything that can be sold as a solution. Products like Inventor, Maya and 3D Studio Max have been used with lots of hand-penned scripts but there's little for mere mortals to get stuck into. It's a fair assumption that Autodesk wants and needs some Form generation capability, this may be based on Maya or Max, as I have reports of 'Aish sightings' at Autodesk's Toronto offices, which is where Alias used to reside. It appears that Aish is getting the scope of what technologies he has at his disposal for product development. For now, Bentley has to get as far ahead as it can with GC, before Autodesk shoves its millions of dollars into the market.

So, enough competitive talk, what was the event like?

The 2008 conference was held in Munich, at the incredible BMW Welt (BMW World) building. Itself an outstanding curvaceous form, the building is a BMW museum, a display area and a community space. Innovation continued into the theatre area where a rising back wall (entrance and exit) came out of the floor – all very cool and a parametric environment in its own right! The sub title of the event was 'Architecture in a Parametric Age'. And before I relay a few of the presentations, I have to say it was far and away the best Smart Geometry conference program I have seen and really depicted the realities of parametric modelling by the leading design firms, many on live or built projects. There was also a healthy dose of theory with the practical, as well as many research presentations leaving you thinking what on earth will happen next in this exciting area. Also of note was the pre-eminence of rapid prototyping models that were on display and the clear focus on post model fabrication, which indicated the traction that was now being forged between modelling and reality.

There were far too many presentations to go through in detail, so I will concentrate on ones



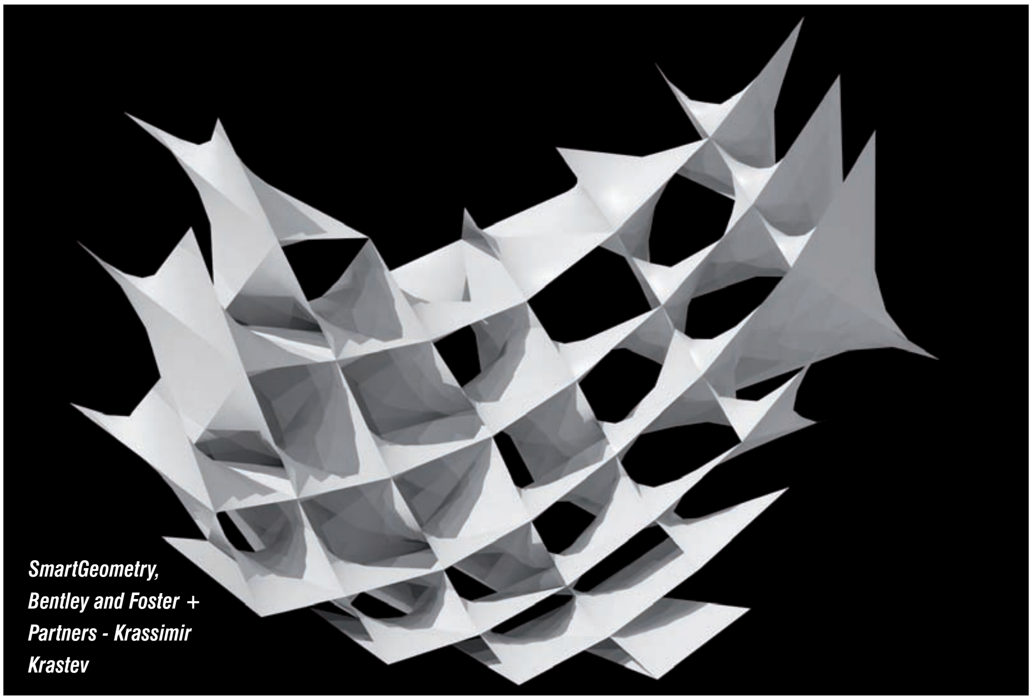
that made the biggest impressions. There were presentations from the likes of: MIT, Zaha Hadid, KPF, Gimshaw, Ecotect and Foster and Partners, together with students from the previously held workshops.

The event kicked off with the SmartGeometry directors answering as a panel, some audience generated questions. It was clear that everybody has different ideas about how this technology will be adopted. To the question 'will all architects become script writers,' Hesselgren (KPF) answered 'almost certainly!'. Parrish (Arup Sport) felt that artistry would always take over from being a geek and in the future systems would require, hopefully, less scripting. Whitehead felt that the technology has a long way to go before it matures as a platform and that it will attract people from different design disciplines and while the current concentration is on building performance and sustainability, that's a natural progression for the technology's capabilities. Whitehead added that despite thoughts that parametric design in architecture would decrease team size and increase output, it's actually increasing the size of design teams due to its complexity and requirements for diverse skills in projects these days.

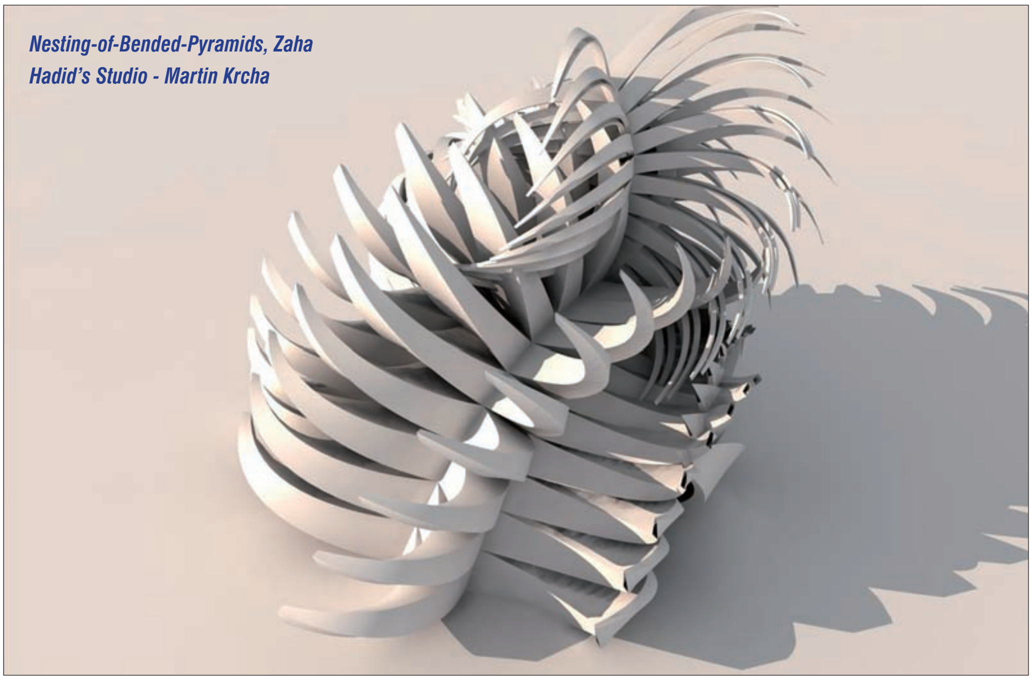
To the question on best practice of deployment of Generative Components, the answers from all the directors seemed to indicate that specialist modelling teams in architect's practices now appear to be the most common way to push this kind of technology into a practice. These teams produce their own tools to capture knowledge. But here there is a divide – the knowledge resides in the architects that are 40 years old plus, where the technology skills are in the kids in

Conceived by international architects TVS, the Dubai Towers was developed using Generative Components and forms the centrepiece for the vast 'Lagoons' development.





SmartGeometry, Bentley and Foster + Partners - Krassimir Krastev



Nesting-of-Bended-Pyramids, Zaha Hadid's Studio - Martin Krcha

(or leaving) universities today.

Asked what still inspires them, Hugh Whitehead answered 'Poetry in pragmatism'. Hesselgren liked to be around people who like what they do, while J. Parrish still got a buzz out of designing a stadium in a computer and having someone build the 1:1 model which he could go and sit in. The team wrapped up with a humorous reflective quote "The older we get, the better we were".

Patrik Schumacher, Zaha Hadid

What can be said about the amazing designs of Zaha Hadid? Probably most would not be possible if it were not for the use of cutting edge technology. The practice is a heavy user of Rhino and a multitude of CAD applications, including Catia. Patrick Schumacher gave a visionary talk on Parametricism as an architectural style'. This takes the concept of using parametric form design from the production of a one off building and applying it to a cityscape. Should the practice be so lucky and influential, which it is, huge swathes of land could be dedicated to an architect's brief, allowing computational generative forms to be applied to standard geometry or skeletal systems to produce a cityscape of individual and unique buildings in response to applying formulas derived from any number of sources. Taking a lead from topology of the curvature of a nearby river could be used and applied to an array of buildings, which would morph and form in the computer to automatically respond to the operands that the architect chooses. This is amazing to watch and really takes parametrics to another dimension, although I have major reservations about what it would be like to live in such a generated building. It would certainly be a unique building and would fit in context by formula but I did find myself wondering "why??".

Hugh Whitehead, Foster and Partners

Whitehead has the tool maker role at Fosters but this year went one step ahead and looked at the 'Architect as the lawmaker'. Using generative tools, together with digital topology, Whitehead was looking at the concept of being able to 'drop' a generative model of a building into a simulated environment, with the correct latitude and longitude, and having the building create the best form for the orientation. And all by taking into consideration the lighting, natural air conditioning, prevailing winds, envelope allowance, and louvres etc. Here the architect would have created the original form and its response to certain conditions, the environment, being the defining factor. It's a fantastic thought and we are probably not that far away from this. The architect would then be the aesthetic judge on the variations that the computations generated.

George Jeronimidis from Reading University

In an absolutely spellbinding presentation, Jeronimidis took us through the world of fibres as a building material. The spider is a great builder, working in 3D it's an architect and fabricator all in one. In today's buildings, joints are always a weak point and give rise to torsion issues and sometimes failures. So what can be done with fibres instead of point, lines, surfaces and solids? When you are fabricating with fibres the material is the structure. Is there anything wrong with knitting the Eiffel Tower? One only has to look at nature to see what can be done with fibres and nature always develops effective solutions. Using nature as an example Jeronimidis thinks that the future will see increased growth of fibrous composite designs that can be designed to intrinsically handle loads better, as the structure can be mapped to stress paths and carried deeper within the materials.

While I am rapidly running out of space to relay much more of the presentations, Bentley has made the event an online event, visit www.smartgeometry2008.com, where streaming sessions will become available.

Conclusion

My final thoughts on the event are that it was truly inspirational and is certainly not to be missed. The one presentation that has been making me think was from a University presentation that was using a 5-axis robot to lay bricks. In itself not exactly a stunning use of a Robot but the team then started playing with the bricklaying, applying transforms to brick walls producing truly complex designs with different sized bricks, generating images, odd alignments and letting the robot just get on with it. The final designs were stunning. The only thing missing was mortar, which was kind of essential and every brick had to be placed by a human hand to the area where the robot could grab it. All these could be easily sorted I am sure with more funding. I think with this event it's clear that technology in architecture is dragging the industry from dumb 2D to something that we only expected in science fiction and it's almost so close you can touch it.

www.smartgeometry2008.com

GenerativeComponents: bridging the gap

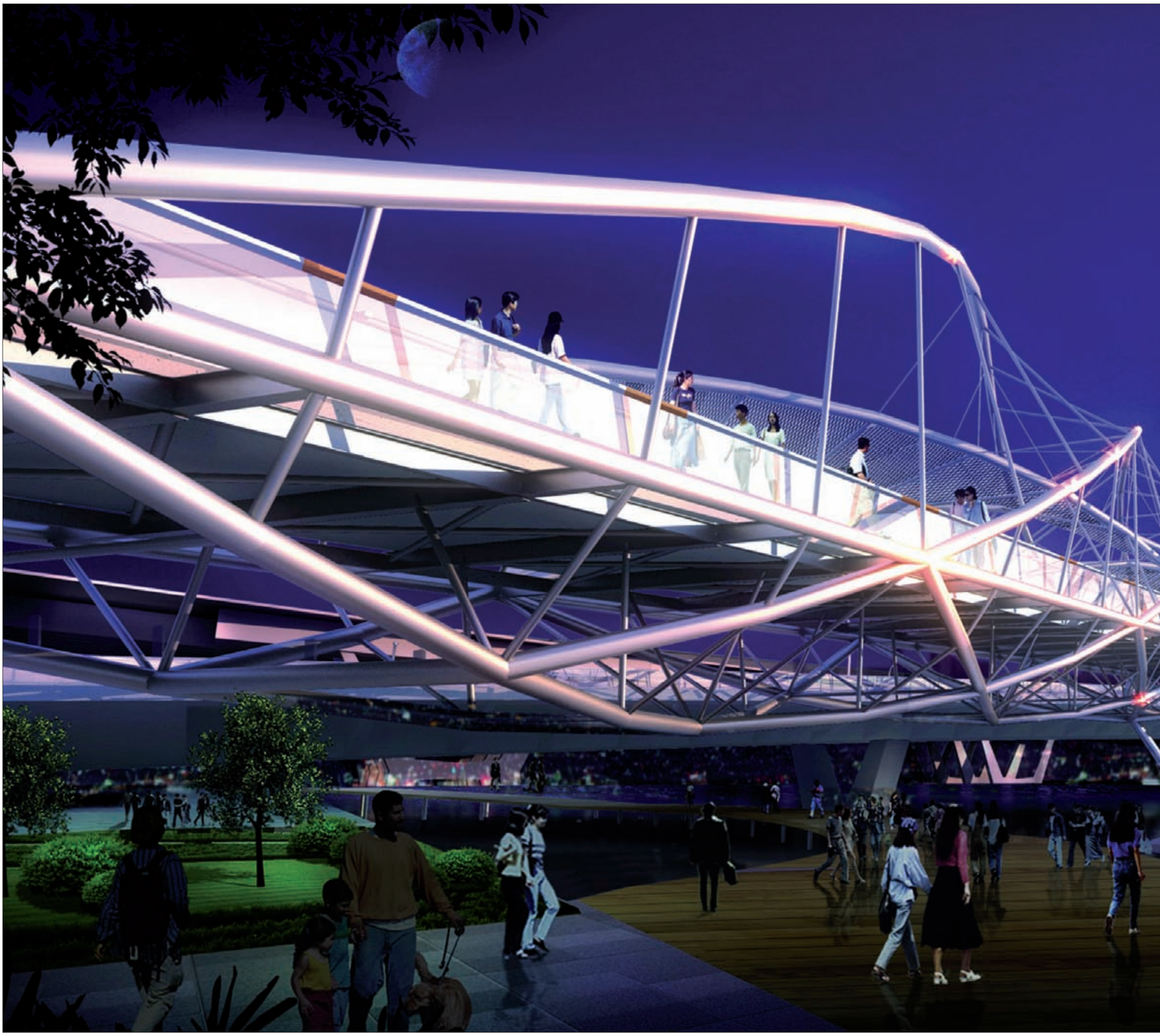
The Marina Bayfront Pedestrian Bridge in Singapore features a double-helix to replicate the designers' vision of walking through a DNA molecule. The creation of this complex form was made possible with the help of Bentley's unique generative design software, GenerativeComponents (GC).

Arup, a leading global design and business consulting firm, knew from the beginning that completing the Marina Bayfront Pedestrian Bridge design project in Singapore would require innovative technology. The 280-metre-long bridge features a double-helix exoskeleton constructed from stainless steel to support a 6-metre-wide deck spanning 65 metres between piers. When it opens in 2009, the bridge will replicate for pedestrians crossing it the designers' vision of walking through a DNA molecule.

What enabled the designers to pursue this inspired design was GenerativeComponents (GC) – Bentley's unique generative design software that captures and exploits the critical relationships between design intent and geometry. GC allows architects and engineers to quickly explore a broad range of "what-if" alternatives for even the most complex structures.

The Marina Bayfront Pedestrian Bridge project presented the type of design challenge for which GC's capabilities are well suited. The bridge's DNA-inspired double-helix structural support mechanism is fundamentally unique. Unlike the Golden Gate Bridge in San Francisco and Millennium Bridge in London, which though different in appearance utilize conventional structural systems, the Marina Bayfront Bridge doesn't belong to any tried-and-tested bridge type.

Moreover, as an aerial view shows, the bridge's centreline adapts to the site geometry, with the



bridge curving in plan while simultaneously rising to a high point in the centre to create a shipping lane. Incorporating the plan curve and vertical geometry within the constraints of the helix rhythm required complex geometry. To understand that geometry and create the necessary drawings to accurately estimate construction costs and coordinate the design between engineering analysis and documentation, Arup needed an innovative 3D modeling solution.

"The main challenge that impacted our ability to coordinate the geometry was associated with finalizing the bridge centreline," said Greg Killen, senior associate in Arup's Brisbane office and design manager of the Marina Bayfront Pedestrian Bridge. "Ultimately, it became a delicate balancing act to provide sufficient clearance for the shipping lane, as well as a gentle slope to move pedestrians comfortably along the bridge. We also needed to create a link to a nearby vehicle bridge, allow pedestrians to pass under the bridge at each abutment, and facilitate supports close to existing bridge supports to reduce the impact on ships navigating the bay."

The design team also understood that any project constructed around complex, nonrepetitive geometry often attracts premium pricing during the tender process. To avoid this, the Arup team deployed sophisticated geometric analysis to rationalise portions of the structure.

By using Bentley's integrated software applications, Arup was able to take advantage of streamlined collaborative workflows that increased the efficiency and productivity of its project teams. For example, by deploying GenerativeComponents, the team could begin modelling the complex helix exoskeleton, even while finalizing the critical bridge centreline geometry, fully confident that the design could accommodate any late changes.

Arup's ability to work simultaneously on linked design tasks allowed compression of the project's critical path. Using InRoads, Bentley's powerful civil engineering design solution, Arup finalized the bridge design centreline for use in GenerativeComponents. GC's flexible associative modelling technology empowered the design team to prepare a model of the double-helix geometry around this critical final design centreline.

By associating this flexible model with the new design centreline, Arup was able to regenerate a complete complex geometry model of the bridge in minutes. The team then imported the wireframe into the main structural analysis and design software applications. Once the structured analysis was complete, Arup used the model in Bentley Structural, Bentley's advanced Building Information Modeling (BIM) application.

This 3D model was then used to prepare fully coordinated drawings. To ensure the structural analysis and design stayed in sync, Arup then returned a post-processed version of the model to the analysis

A string of computer-controlled lights along each helix will turn the bridge into an active element during evening fireworks displays and light shows. These multicolored lights are designed to mimic the chemical processes found in DNA replication.





program. MicroStation's support for industry file and data standards, as well as connecting the geometry with the analysis engine, greatly enhanced this process.

By using MicroStation's Visual Basic macro capabilities to generate Excel spreadsheets, Arup statistically analyzed the component geometry to develop new curve geometry that used one bend radius for each of the two spirals that formed the double helix. This increased bending speed and reduced the waste associated with the cold-bending process, which saved on stainless steel costs.

Arup then combined the structural analysis results with the Bentley Structural model by using the 'Place Member along Path' tool to quickly regenerate a 3D solid model. Combining this with the BIM drawing production technology allowed Arup to quickly and accurately create as many drawings as necessary to describe the complex design.

With the structural design in hand, Arup could turn its attention to designing the glazing panels that form the bridge canopy. Arup again modified the GenerativeComponents model to include the design team's intent for the complex panel arrangement.

Initially, the Arup team was concerned that once it had completed the helix rationalization, the complex arrangement of panels and the bridge geometry would result in the panels being of unique size. However, using the Visual Basic capabilities Arup was able to populate a spreadsheet of the panel geometries for analysis. This proved that for a given tolerance – of about 2 to 3 millimetres – the panels could be grouped into sizes that, for fabrication purposes, could be considered the same, which significantly reduced glazing costs. The design team knew that it could

What is GenerativeComponents?

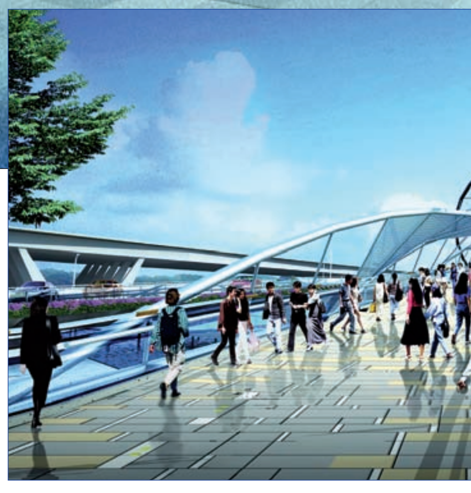
GenerativeComponents enables architects and engineers to pursue designs and achieve results that were virtually unthinkable before. Empowered by computational methods, the designers can direct their creativity to deliver inspired sustainable buildings that are freer in form and use innovative materials and assemblies. GenerativeComponents facilitates this by allowing the quick exploration of a broad range of "what-if" alternatives for even the most complex buildings.

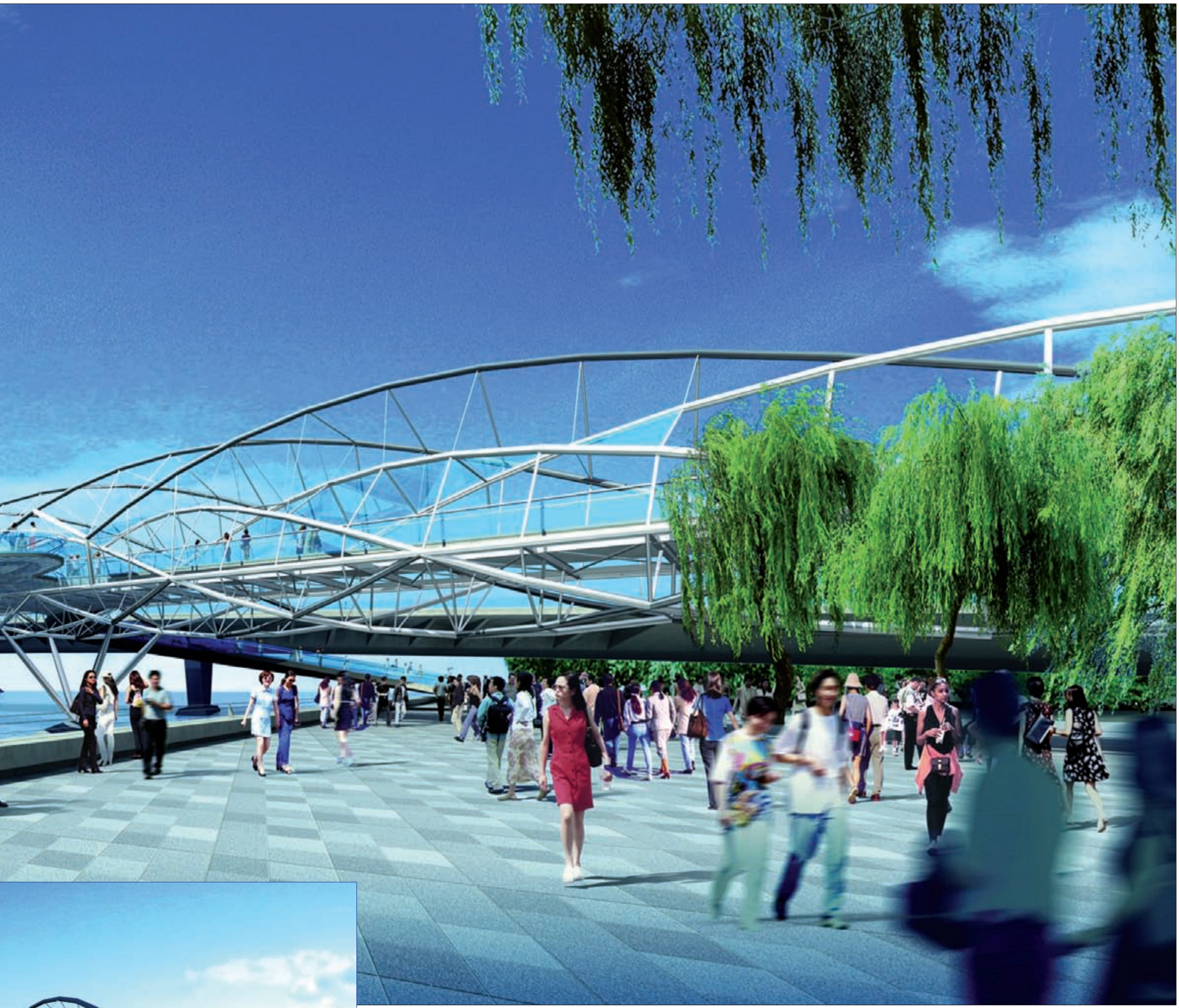
This unique generative design software captures and exploits the critical relationships between design intent and geometry. Designs can be refined by either dynamically modeling and directly manipulating geometry, by applying rules and capturing relationships among building elements, or by defining complex building forms and systems through concisely expressed algorithms.

To inform decisions, GenerativeComponents is integrated with building information modeling, analysis, and simulation software, providing feedback on building materials, assemblies, systems performance, and environmental conditions. This integration also ensures that intent becomes reality by enabling designs to accurately and efficiently flow through to detailed production and fabrication.

GenerativeComponents is already enabling leading architects and engineers around the world to deliver inspired sustainable buildings. Among them are Arup, Buro Happold, Foster + Partners, Grimshaw Architects, HOK, Kohn Pedersen Fox Associates, Morphosis, and SHoP Architects.

For more information about GenerativeComponents and the forthcoming GenerativeComponents Discovery Subscription program, visit ***www.bentley.com/gc***







reduce fabrication costs by representing the double-curved helix geometry with a series of single-curved (planar) segments.

Since GenerativeComponents allowed the Arup team to recognize, and have more control over, geometric parameters, it was able to investigate design ideas more quickly. For example, through GenerativeComponents Arup discovered it could reduce the weight of the bridge by using a fifth less steel than is generally required to construct a conventional box girder structure.

In addition to facilitating the geometry coordination, Bentley BIM in conjunction with GC allowed Arup to identify sets of repetitive components with the complex spiraling geometry. Moreover, GC enabled the Arup design team to model the complex detail geometry before finalizing the over site geometry. The time-saving flexible modelling technology within GC enabled Arup to update the geometry in minutes rather than hours. This ability allowed the team to make changes and explore options they could not have imagined.

Without deploying Bentley products on the Marina Bayfront Pedestrian Bridge, achieving this design would have required using expensive software, a dedicated 3D graphics programmer, and considerably more time, which would have added costs for the client, Singapore's Urban Redevelopment Authority.

For Arup, Bentley products formed the back bone of its design, analysis, engineering, and documentation processes. The products provided the power and flexibility required to successfully complete complex projects, while maintaining construction schedules and holding the line on costs in the process. **www.bentley.com/gc**

A bridge to future renewal and growth

The 280-metre-long Marina Bayfront Pedestrian Bridge in Singapore will not only serve as a walking route, but also be a worthwhile destination in itself. The 6-metre-wide footbridge, encircled by opposing double-helix structures that create the designers' vision of a DNA molecule, will be the sole link between the central business district and the world's largest casino complex currently under construction on the southern bank of Marina Bay.

Residents and visitors to the city will have access to large balconies spaced at several points along the bridge with platforms for viewing the city and the bay. Although it is difficult to estimate how many pedestrians will cross the bridge on a daily basis, a prominently located pedestrian bridge in a major city typically carries approximately 60,000 people a week.

A string of computer-controlled lights along each helix will turn the bridge into an active element during evening fireworks displays and light shows. These multicoloured lights are designed to mimic the chemical processes found in DNA replication – the basic building block of life symbolizing renewal and growth and reflecting Singapore's own aspirations for Marina Bay.

The key to successful software adoption

As successful as an architectural practice can get there's still room for improvement. **Richard Mitchell** looks at how a Scottish design team got to grips with their new software investment through some tailored training from Excitech.

Since 2005, Dundee based architects Wellwood Leslie, responsible for such projects as the clubhouse refurbishment at The Royal and Ancient Golf Club of St Andrews, and Carnoustie Golf Course Hotel and Resort, have continued to grow and invest in the latest CAD tools.

Expanding its team of architects, technicians and support staff to cope with new projects, the practice has always strongly believed in using the latest design tools; turning to AutoCAD Architecture in 2005 to enhance its existing CAD software.

Having invested in the software on a trial basis for a project the firm were keen to see what it was capable of and decided to test it in a live project environment.

Recognising the need for assistance with a new software product, Wellwood Leslie contacted Excitech, their CAD partner, who were able to create a number of bespoke training courses aimed at providing the practice's CAD users with the necessary skills to begin using AutoCAD Architecture.

"Whilst we were aware that other training organisations could have provided courses at a slightly lower price, we recognised the industry insight and quality Excitech possessed," said Brian Smith, partner at Wellwood Leslie.

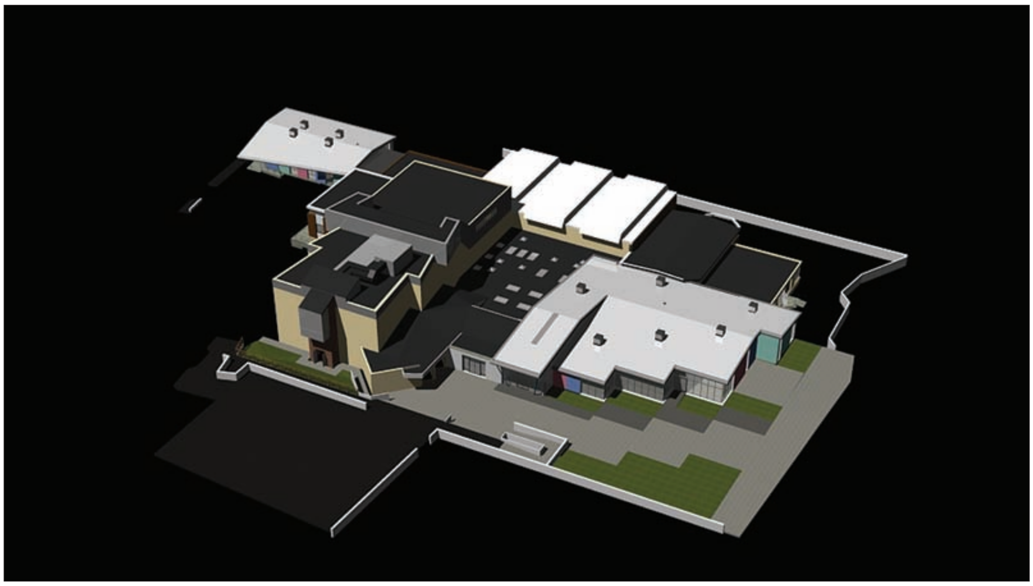
"Our preference has always been to carry out training with our vendors, so choosing Excitech was a natural choice," explains Brian.

Recognising at the outset that a key factor in the long-term success of the software was how well the design team embraced it, the firm requested that the entire architecture team received basic training, despite only four members being involved on the initial project. Training comprised of a bespoke two-day features overview focusing specifically on design and documentation, before a further two bespoke courses for the project team. These were provided in two stages as high-level one-day training courses focusing on project administration and system configuration.

Once training was completed the firm chose a project to utilise the new software and skills on. "We decided, some might say rather rashly, to use AutoCAD Architecture on a large scale mixed-use redevelopment and extension in Fife," said senior architectural technician Steve Mathewson. "Whilst it was quite daunting at the time we knew it would give us the perfect environment to see just how effective the software could be."

Having completed the project successfully, while meeting project deadlines, the practice has realised the benefits of using AutoCAD Architecture, but like many successful adopters of discipline-specific design tools, there is a realisation that there is still much to learn.





Loch Gelly's multi-purpose civic centre.



"We are still learning how to use the software. It's a bit like group therapy with everyone working together to help each other when problems arise," admitted Steve. "We have a basic understanding of the software but we're keen to take our usage and understanding of the product to the next level."

However, for Wellwood Leslie, the key to successful adoption is down to persistence. "Like any new piece of software you really have to use it on a frequent basis to ensure that the features and functionality of the software actually stick in the user's mind. At the moment we have a number of users who have been trained and are aware of the features but who aren't using the product on a daily basis, so for them remembering how to use some of the features is quite hard," added Steve.

That being said, Wellwood Leslie gives the impression of being a forward thinking company that recognises the benefits continuous training can bring to its team. As well as developing a more effective workforce and the training here seems to have empowered its staff, allowing the company to increase an already excellent staff retention level.

"The biggest asset that any company has is its staff, particularly in such a fast moving industry where skills are at a premium. One of the reasons we were keen to gain our Investor in People accreditation was to show just how committed we are to investing in our staff, not only by giving them the best tools to do their jobs, but also to support them with the best training", explained Brian.

As part of their culture of staff investment, Wellwood Leslie is now committed to an annual training programme linked to the company's Autodesk software subscriptions. "We recognise that each year Autodesk are releasing new software and with each release comes more functionality and refinement. As the functionality becomes ever more complex there is a need to receive training to ensure that our staff stay informed of all the new features and, in essence, ahead of the game."

Brian concludes by explaining that the practice has been fortunate to work with such an informed company as Excitech who "proved to be an excellent partner."

"The industry-knowledge and product understanding along with tailored training has meant that we have been able to roll-out new software and working practices successfully. On top of this, the constant support we receive from Excitech has been outstanding. Having that level of assurance and support has allowed our team to flourish with the new software and perhaps even succeed where others may have failed."

www.excitech.co.uk
www.wellwoodleslie.com

Best face forward

London architects Newtecnic utilise Gehry Technologies Digital Project (DP) software to create structural building facades that are innovative, beautiful and buildable. By **Nick Lerner.**

London based Architects, Newtecnic specialise in architectural facades using complex geometry. Their work ranges from large-scale projects currently including developments in Moscow, Dubai, Kuwait and St. Petersburg to large-scale residential projects in London. The firm develops innovative technical facade solutions that are optimised for efficient manufacture and fabrication.

Before founding Newtecnic Andrew Watts worked on high profile projects including the iconic Institute du Monde Arabe, Paris, and LAB's Federation Square in Melbourne, while co-director Yasmin Watts worked on Renzo Piano's remarkable New Caledonia Cultural Centre.

Because Newtecnic's facade systems function structurally their work goes far beyond conceptual design and, as a result necessitates evolving a complete manufacturing methodology. To handle this level of involvement Newtecnic deploys Digital Project software, which was developed by Gehry Technologies





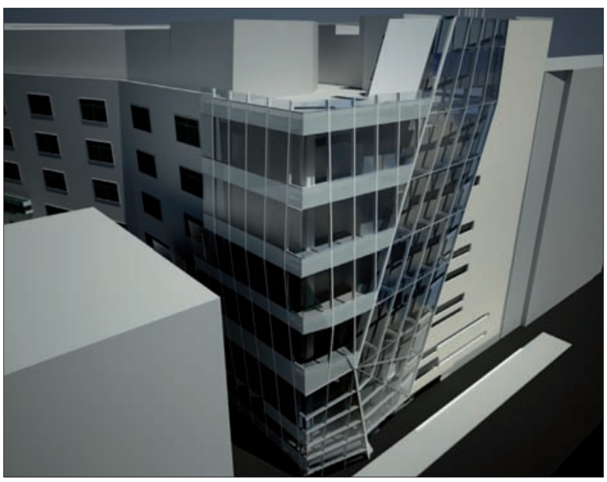
and based on Dassault Systemes Catia V5 PLM system - the same software that is used by companies including Boeing and Toyota to design and build the worlds most advanced engineered products.

Liberation

Andrew Watts explained his choice, "The ability to turn conceptual designs into buildable structures while retaining the precision of the original creative intention requires the equally precise methodology that DP parametric software provides. This tool is liberating because it allows designers to iterate the design within a set of flexible governing rules. Some architects reject this type of tool because they feel that it compromises their vision but at Newtecnic it liberates us by allowing considerable creativity within the rigour of strict rule based engineering discipline."

He continued, "The way modern buildings are designed has changed to accommodate ideas about how usage will alter over time. Consequently spaces are much more flexible and non-specific. This means that the mechanical services of a building will change along with the usage so a 3D building model is the ideal repository for the design because it allows changes to be made over time; effectively extending the design period over the life of the building.

"The process of making buildings is becoming more complex and the tools such as DP are developing along with that process. Many architects have wanted to have this type of tool for years and now it is finally available. The ability to change a building while retaining the integrity of the design vision allows us not only to design faster and more easily but to show interested parties how the design is developing in ways that they can understand and make best use of.



Into the 4th Dimension

"In the past architectural drawings were impenetrable to most people but with DP we have the tool that shows exactly what we mean, including its environmental intervention.

"DP also gives us the remarkable ability to include the 4th dimension - time. In real life we observe the world in time but traditionally architects do not include time because their drawings are static. The animation tool in DP allows us to describe the energy and drama of a design, which in a traditional 2D drawing may be stylish but actually gives nothing away. It is not possible to draw in a way that includes time and therefore drawing will never deliver the whole vision. Time gives the drawing reality and also enables the practical advantage of communicating the details of a façade system and how that will change to accommodate the shape of a building to all involved from the client and the occupant to the fabricator and the construction team. Another function of this feature is that it enables a view of accelerated weathering of a building over an extended time period, which is both fascinating and an important planning tool."

The DP infrastructure at Newtecnic was supplied by Gehry Technologies' UK representative, Desktop Engineering which has provided systems and ongoing support for other leading architectural practices including Zaha Hadid, SOM, Allies and Morrison and Thomas Heatherwick. Geoff Haines Desktop Engineering's MD said, "The uptake of DP in the UK has accelerated over the past 12 months because firms in the AEC business have recognised that this software allows them to realise their vision by making designs buildable."Newtecnic has recently been working on the Gazprom Building planned for St Petersburg. Andrew Watts described the firm's work

on the project, “The Gazprom Building work was won through a competition by RMJM against several of the world’s leading architects. The design is based on a single stack rotated through 2.5 degrees multiplied over 5 towers. The whole building describes a twisted taper. The facade was developed in DP with a new system of shell-like panels across the faces of the structure. DP is being used to minimise the panel variation and to design the whole façade system including the smallest detail. The ability to do all the work in one software package rather than having to jump between several makes the work flow much smoother and saves time in the design process. This is one example where DP’s parametric methodology really shows its strength because changing one element automatically updates those related to it.

Math generation

“The Gazprom tower is a mathematical model from which we can generate visual, engineering data and excel output that allows us to alter the building and its details while maintaining full control over the design and its associated reports. The model can be altered using excel, and vice versa, which provides us with greater design flexibility along with the ability to make multiple changes quickly. DP allows us to simplify complex geometric shapes and produce interrelated patterns from them. In the Gazprom Building for example shapes are laid out on a simple curve even though the finished model looks much more complex.

Andrew Watts is aware of the place that DP has in the history of tools available to architects and says, “Use of DP is similar to the use of tools in C15th gothic churches – callipers, plumb line and a set square, with which builders created magical effects, DP is simply an up to date tool. There is a continuum of ideas and tools in architecture even though many people treat history as a free toyshop rather seeing themselves as adding to the wealth of past experience.

“Like architects of the past, Newtecnic works with companies that fabricate building components and physically construct buildings so our work goes far beyond conceptual design. Currently this is unusual practice because division of labour often creates a separation between designers and those who carry out the labour of construction. DP allows everyone to be part of the building process and to take from the model that which they need to effectively and efficiently manage their work.

“DP allows us to quantify what we have in our heads and shows you how to build the building and its constituent parts. It puts us onto a strong position throughout the design-to-production process by enabling a complete and totally accurate project vision.”

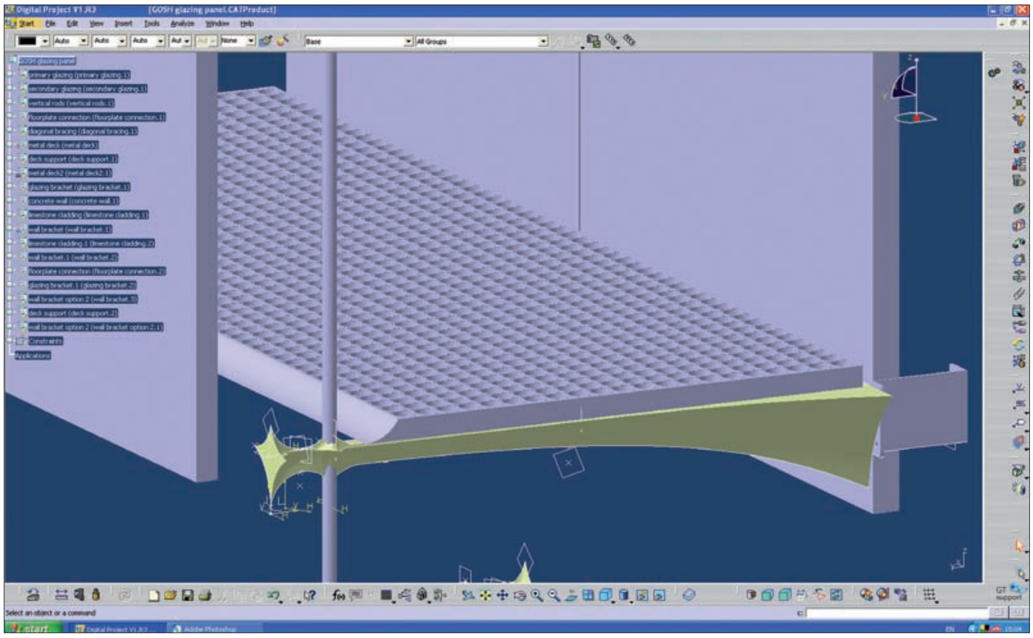
Kids stuff

At Great Ormond Street Childrens’ Hospital Newtecnic is working with leading architects Llewellyn Davis Yeang, on a folded glass facade with Newtecnic producing detail designs from concept to component. Interestingly the tapered castings of one design option that hold the glass panels are reminiscent of a gothic design which has been optimised using FEA (finite element analysis) the results of which were fed into DP to inform the final model.

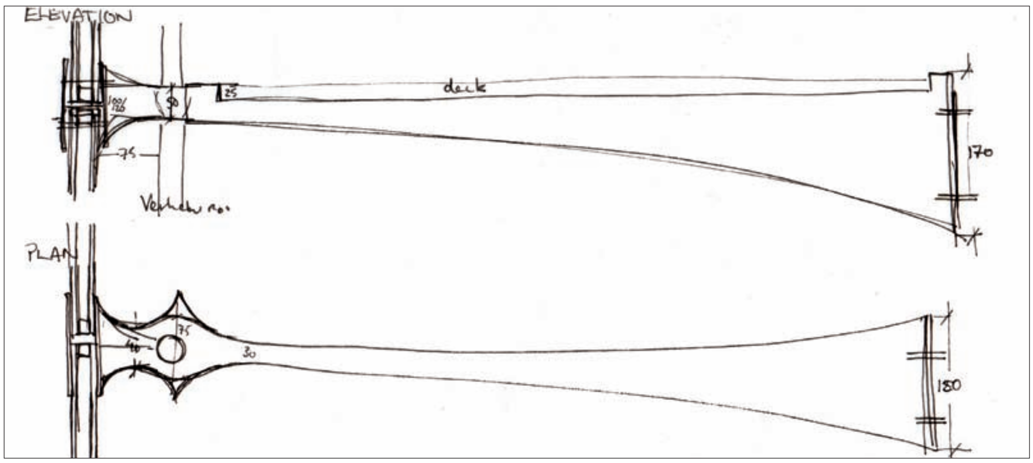
Andrew Watts commented, “Our brief was to create a folded glass wall design including final fabrication and construction details. An original wireframe model for the building was provided and input to DP. The parametric capability within DP allows us to change the design easily to fit with the demand of clients, designers, planners and others involved in the process. The final design will be a lovely crafted, friendly building that is sensitive to the functional and emotional needs of its users. It will be appear modest through the use of appropriate components. DP has allowed us the design freedom to achieve this level of sensitivity along with absolute technical rigour so that the structure and its components are guaranteed to be fabricatable.

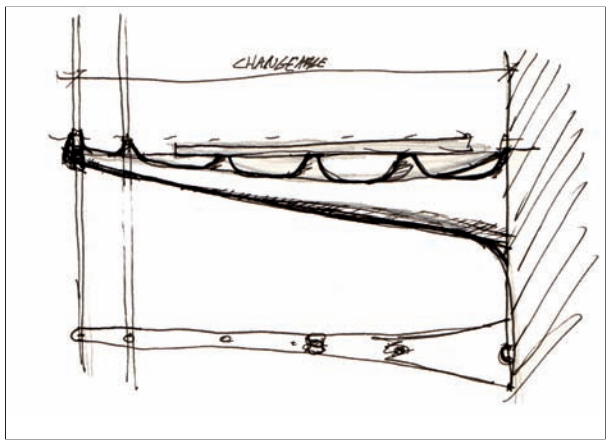
In conclusion Andrew Watts said, “DP is able to reveal the complexity of a design in a simple and readable way. It helps to make things straightforward.

This saves hours of talking and explanation because we can show what we mean in a split second.” **www.dte.co.uk** **www.newtecnic.com**



The tapered castings that hold the glass panels on the Great Ormond Street re-development project are reminiscent of a gothic design which has been optimised using FEA (finite element analysis) the results of which were fed into DP to inform the final model.





Benchmarking CAD skills for recruitment

A more targeted approach to benchmarking CAD skills for recruitment can give HR managers support in assessing the technical competence of candidates at interview stage, says **Rory Vance**, Managing Director, CADsmart.

Inefficient use of CAD technology in industry wastes millions of pounds each year. It is vitally important that HR teams in UK businesses have the tools to quantify the skills of new CAD members of staff, to make sure that they are right for the role in question, and that the role in question is right for them. Companies need to ensure the optimum performance of technical staff to deliver crucial workloads accurately in a highly pressurised environment.

Many companies today employ CAD technology on multiple projects at the same time, often across a number of offices, even across several locations worldwide. This, combined with the trend towards outsourcing and off-shoring of production information work, means it is vitally important to be able to benchmark the performance of teams using CAD software to maintain high standards.

It is essential that design and construction firms are able to quantify the performance of CAD teams, particularly when recruiting new staff. More enlightened firms are responding to this need by implementing a roadmap to enable a better return on their considerable investment in CAD technology.

At the same time, HR teams need clear direction on how to improve CAD operative standards. Until recently, lack of quality information relating to CAD productivity and performance has meant that HR teams have not been able to develop appropriate training plans, and develop a more strategic and accurate approach to recruitment, resourcing, new staff inductions, software upgrades and annual appraisals.

Although CAD has been used on projects for more than 15 years, the construction industry has never really had a formula or suitable metrics in place to monitor and benchmark the efficiency with which this technology is being used. Often, due to project pressure, and a lack of an industry standard for CAD, recruiters have relied upon references, or trusting that a candidate's CV and portfolio really are a true representation of his or her CAD ability. Inevitably, this is not always the case. This hit and miss approach to hiring new staff can prove costly.

Both HR and CAD managers can benefit from a clearer understanding of an individual's ability to use CAD software. Communication between HR management and IT management can be improved with better visibility of each individual candidate's core skills.

When planning CAD training and development programmes, it is important to consider each user and the typical circumstances in which CAD is used during the course of their work. Some may be full-time users, while others may only use the tool occasionally.

CAD training and resourcing in the construction industry

The following data illustrate companies' attitudes to CAD training and resourcing in the construction industry:

- 20 per cent of companies do not set any money aside for training;
- 56.3 per cent of companies have an official company training policy;
- only 18.8 per cent have a structured CAD training scheme;
- 16.3 per cent of companies rely on the users to request training and 32.5 per cent rely on logged support calls to form CAD training content, while 32.5 per cent of companies rely solely on their CAD manager to decide on training content;
- 78.8 per cent of CAD managers are responsible for providing internal training;
- an average of 44.5 per cent of a company's training budget is spent on CAD training;
- 60 per cent of practices test the CAD ability of interview candidates;
- 80 per cent induct CAD staff once they have started work;
- 25 per cent always prefer to send their staff out for CAD training;
- 15 per cent never send their staff on external CAD training;
- 75 per cent prefer their training to be bespoke;
- 67 per cent of firms state lack of time/ resources as a reason for not sending people out to CAD training courses.

(**Source:** *Evolve Consultancy CAD Manager's Survey 2007; data based on responses from 128 registered UK architectural, engineering and construction firms.* www.evolve-consultancy.com)

A project running in the UK construction industry since 2003 has captured the results of more than 6,000 individual CAD skills assessments, all taken using CADsmart independent testing software. The results comprise a national CAD benchmark - a standard against which companies can compare their own staff CAD performance - and have set meaningful targets for improvement.

ºIt is estimated that a staggering 75 per cent of the UK construction industry's working drawings produced during the design stage are created using



Points for thought

There are several benefits to be gained from benchmarking CAD productivity. These include:

- gain visibility of CAD skills;
- identify individuals' strengths and weaknesses;
- better CAD training plans for staff;
- improve recruitment processes;
- share performance data across an organization;
- promote collaborative working between teams and offices;
- measure the performance of outsourcing or off-shoring partners;
- best practice for CAD development;
- clearer staff inductions;
- more meaningful staff appraisals;
- better skills resourcing for projects;
- continuous-improvement process for CAD;
- save time and money;
- best value for clients.

www.cadsmart.net

CAD software. In a sector estimated to make up about 10 per cent of UK gross domestic product, approaching £95 billion each year, the fact that so many firms are dependent upon the accuracy and efficiency of their CAD operatives is significant.

Missed deadlines, project reworking, problems on site caused by inaccurate drawings - a host of issues can lead to construction projects experiencing delays during build phase, which could easily have been avoided with better working practices at the design stage. The consequences of inaccurate drawings can be significant, not only in terms of the knock-on effect across the entire project, but also financially technical errors and slow delivery of drawings can have an immediate impact upon the project's financial profits and ultimately the bottom line of the entire company.

Architects, civil engineers, structural engineers, technologists, building-services engineers, technicians, surveyors, landscape designers, house builders and contractors each use CAD in a distinctly different way. Tailoring training and development plans to reflect these individual needs is not only more effective, but costs less, too.

Typically, when planning CAD training courses, the industry has a habit of spending its budget on non-tailored, "off the shelf" style courses or software-upgrade modules from vendors and resellers. This does not always provide the best return on investment, as seldom does the course content apply to their staff's individual needs or project types.

By mapping the training courses to gaps in each user's knowledge, and by using a mix of in-house resources and formal external training, the learning environment is much more relevant, and results are demonstrably better.

The options available for improvement

Companies identifying individual user ability and experience using CAD can consider a range of options:

- appoint a CAD reseller or preferred training partner to conduct one-to-one interviews with staff to gauge their level of CAD experience;
- task the CAD management team with developing an in-house "CAD test" for existing teams and new recruits;
- appoint a preferred recruitment agency to quantify CAD knowledge during initial candidate interview and to reference check the CAD credentials of potential new starters;
- investigate more formal examinations, such as C&G (City & Guilds) 2D and 3D CAD, CAD vendor certification exams post-training, or the ECDL (European Computer Driving Licence) 2D CAD course;
- search the web for a "multi-choice" question-type assessment that captures individual CAD knowledge;
- use a CAD skills-assessment software package – such as CADsmart – to benchmark CAD teams and feed performance data into more targeted training and recruitment programmes.

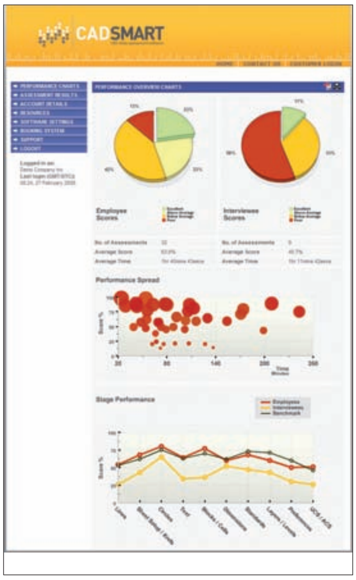




The advantages of the assessment-software approach

A number of engineering consultancies, architectural practices and local authorities are adopting the assessment-software approach to help to measure and improve CAD productivity. The results of every assessment allow each organization to access, sort and analyze the data and then apply the outcomes to the business.

The assessment data feeds into specific, targeted training programmes and workshops for AutoCAD and Microstation, the two most commonly used CAD software products in the UK.



The data can also benefit firms when used as part of a structured recruitment process.

A couple of case studies

Benoy is an international firm of award-winning architects, masterplanners, interior and graphic designers working from offices in the UK, Middle and Far East. The company has a dynamic and well-managed CAD team that mainly uses Autodesk software for the production of information and detailing work. The practice has been using CADsmart since 2004, to help to monitor CAD development.

Associate director Paul Carnell observed: "CADsmart allows us accurately to understand the skills base of our current and prospective colleagues and enables the continuous development and maintenance of high-level CAD standards within our practice."

WSP Group plc is a global business providing design, engineering, management and consultancy services to the built and natural environment. WSP has around 8,000 staff operating from more than 100 offices in Africa, Asia, Europe, the Middle East, north America and Oceania.

WSP has a large CAD resource, using Autodesk and Bentley software for its production information and detailing work. The practice has been using CADsmart since 2006, to help to maintain a high level of CAD productivity between the group's offices.

David Hoole, UK CAD improvement manager, explained: "CADsmart has proved to be a valuable tool in increasing visibility and understanding of our large and diverse CAD user-base. The individual assessments combine to allow us to develop targeted training programmes, making efficient use of our resources. In addition to training needs analysis, CADsmart assessment also forms part of our recruitment process, helping to provide a more objective view of potential employees."

Great scope for productivity gains

To highlight the risks of recruiting unknown CAD personnel, a six-month live exercise was carried out across nine UK firms of engineering and architectural practices. During this time the basic CAD skills of 85 recruits were assessed at interview.

Accuracy scores achieved by those taking the exercise ranged from 5 per cent to 95 per cent. The time the candidates took to complete the assessment ranged from 26 minutes to over four hours. This demonstrates the broad range of basic CAD skills in today's marketplace.

Once a company knows what people can and cannot do with CAD, the firm can both provide a more valuable induction process for new recruits, and know with confidence where to place new starters within the organization.

The research has shown that, by targeting simple performance improvements each year, companies can make significant productivity gains.

Take an average salary of £25k p.a. and a 225-day working year.

For every 1 per cent improvement in productivity, a practice could save £250, or 2.25 days per person per year.

A target of 5 per cent annual improvement in performance is worth £1,250, or 11.25 days per person per year. Remember that 11.25 days is the equivalent to 90 working hours, based on an average eight-hour working day.

All of this means that a company with 20 staff could be seeing a saving that is worth the equivalent of a new member of staff (20 x £1,250 = £25,000).

Improving the visibility of the CAD ability of incoming staff can save money and time.

Employing inappropriate personnel for three months can be expensive. Consider the following:

Permanent:

Assuming a £25k annual salary:

15 per cent agency fee = £3,750

3 months' salary = £6,250

Contract:

Assuming £18/hr:

7.5 hrs x 5 days = £675 x 12 weeks = £8,100

These examples do not include advertising costs for staff employed directly, or the cost of reworking for drawings that were not done right first time.

Industry Best Practice

Leading industry influencers are now promoting best practice for CAD performance improvement. These include the IT Construction Forum, Construct I.T., ACE and ICE.

www.constructingexcellence.org.uk

www.construct-it.org.uk

www.acenet.co.uk

www.ice.org.uk

Training day

With the imminent release of Autodesk's 2009 AutoCAD and Revit platforms, what options are available to engineering and architecture firms to keep on top of educating staff to use new features? **Stephen Holmes** looks at the approaches being taken to make training both effective and justifiable in the modern workplace.

Often considered an expensive luxury, training for CAD users is becoming an annual dilemma for architects and engineers across the country. With 67 per cent of firms stating a lack of time and resources as a reason for not sending staff out to CAD training courses, online and self learning materials are becoming more popular due to their ability to be used anytime, anyplace. But is this the end of traditional classroom training? We approached two of the biggest CAD training companies in the country and found that things haven't moved on quite as quickly as perceived.

"In the last couple of years we've seen a general move for clients very concerned about releasing a lot of people at a time, across a number of days because of the downtime that they get," says Claire Bass, CADline. "We're doing a lot more training at client's sites – so we've got a lot more mobile training kit that we take around the country with us."

Training in excess of 3,000 people each year, the majority of CADLine's methods centre on variations of the classroom format, the majority being six people to a room, each with a PC.

The company offers a training skills analysis upfront which is designed to find the areas that delegates aren't up to speed on, then get them to sit on only those modules. "What you tend to find when you go on a two-day course is that there's usually some of it that you know. What we're trying to do is stop people having to repeat training just for the convenience of sitting on a scheduled training course," maintains Claire. "It is still very intensive, focused training that gets the better results. I think that the very large corporations that have got hundreds and hundreds of people to train will be more imaginative on how to get some training for all, rather than very intensive training for a few. Some of that's about E-training as well."

The boom in E-training has yet to materialise. Most architectural practises are still as sceptical of internet and DVD courses as they were nearly a decade ago. In a survey from the Business Advantage Group published in 2001, 57 per cent stated that they would not be interested in web-based training in the future. Only 19 per cent expressed a positive reaction. Currently, training firms are seeing increasing competition from online tutorials and suppliers of training DVDs and are busy promoting their own E-learning capabilities. However they remain adamant that the best returns on investment are still to be found in traditional training.

"I think these new methods are really exciting, but a formula doesn't yet exist which is better than classroom training," says Susanne Hayward, Excitech. "Whether we're delivering courses in our training centres or on a customers premises this is still the best form of training. It's all very well sitting down and watching a video but it's very much a one-way dialogue. Training is very much a two-way dialogue and being able to ask questions and learn from a skilled professional is beneficial. Most of our trainers have spent a significant amount of time training CAD users so as well as understanding the products inside out, they understand what the person actually receiving the training needs and how best to deliver it to suit that individual requirement. You just can't get that from sitting in front of on online tutorial or DVD.

> **"Almost all of the companies we're working closely with see the benefits of using the likes of Revit over traditional 2D draughting tools but the biggest barrier to adoption is the current skills shortage"**
>
> **Susanne Hayward, Excitech**

That said, Excitech, is looking at ways of expanding its methods in the near future to incorporate new training methods, as the delivery of these becomes more viable.

"I think there is still a perception that training is a luxury, because some companies still struggle to make the cost justification," explains Susanne. "But with the likes of Revit and some of the vertical AutoCAD applications there is a need to receive significant training to ensure that you gain the maximum return on the software investment made. Making that investment up front means that companies can reap the productivity benefits in a much shorter timescale. I think it's fair to say that there are an increasing number of progressive companies in the UK who are doing just that and really starting to see the benefits from using the likes of Revit.

"I think the biggest challenge at the moment is trying to increase the adoption of these products more widely in the UK. Almost all of the companies we're working closely with see the benefits of using the likes of Revit over traditional 2D draughting tools but the biggest barrier to adoption is the current skills shortage. Because these products are still relatively new, the skillbase is small and right now the only way this can be addressed is by progressive companies utilising the likes of Excitech who have the skills and expertise to assist in imparting the knowledge and understanding of these products on to existing employees.

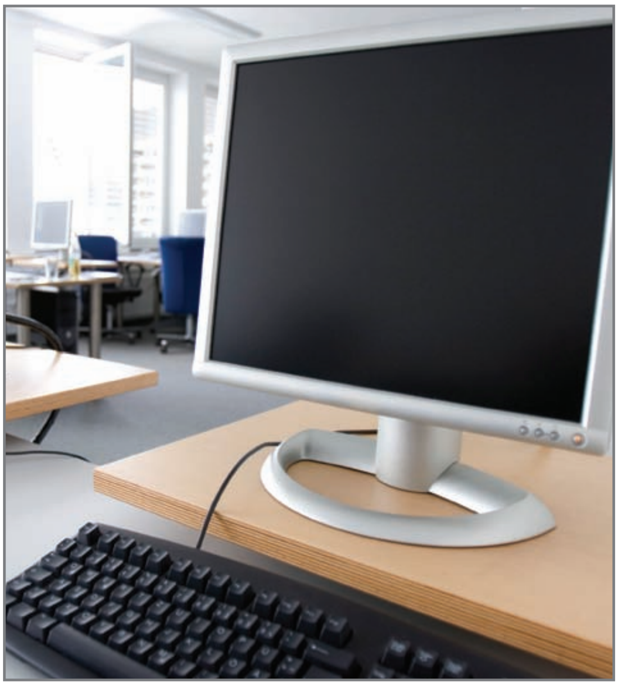
Training for staff seems to prove as much of an investment as taking up new software. Claire Bass views the return on this investment as 'Immense'.

"You're taking very laborious tasks and automating them, so the return on investment there is quite straightforward. The truth is that there are very few companies that are choosing to put the staff through upgrade training every year. What they tend to do is AutoCAD training, they do it every two or three years to refresh more than anything else, because a new version – unless you get a very significant update – doesn't stop you working.

"But what it does do is damage your efficiency and productivity gains because you're not taking advantage of all the latest and greatest."

Susanne Hayward agrees, explaining that the utilisation of training can have an extremely positive effect on a workforce. "Companies who very much see themselves as learning organisations and embrace training tend to have a significantly increased staff retention and create a motivated, empowered and more productive team as staff see the investment the company is making in them."

www.excitech.co.uk
www.cadline.co.uk



Green thinking

Ecotect is one of a new generation of so called ‘green’ building analysis programs. Since adopting the software, architect **Alan Gillard** has been able to base his designs on more than just ‘green gut feeling’.

I first got interested in Ecotect while studying for a master’s degree in the Environmental Design of Buildings at Cardiff University back in 2002.

Ecotect is building performance analysis software designed by architects for use by architects. Whilst learning about simulation and analysis of building performance as part of the taught course, I was involved in the early trials of Ecotect, then being developed by Dr Andrew Marsh. It was particularly useful when I was investigating my thesis subject – still an area I have a great interest in – the application of interseasonal heat storage in small buildings. Despite its potential for pursuing specialist interests, Ecotect is a software that all practitioners with a general interest in environmental design can learn to use. Our staff pick it up as a part of our working methodology and without previous training.

This early test-driving convinced me to look into how my own practice could benefit from using building performance analysis software. Now, some four years later, I regularly use Ecotect in the early stages of sketch design, to assess the environmental performance of our projects.

Using Ecotect, we are able to show clients how an investment in sustainable design will pay off in the future in, for example, the reduction of energy bills for heating, cooling, or lighting. We can investigate the effectiveness of other building improvements, like solar panels or collectors, shading devices, different glazing configurations, and a raft of other variables, to see how these measures affect a building’s performance or even viability.

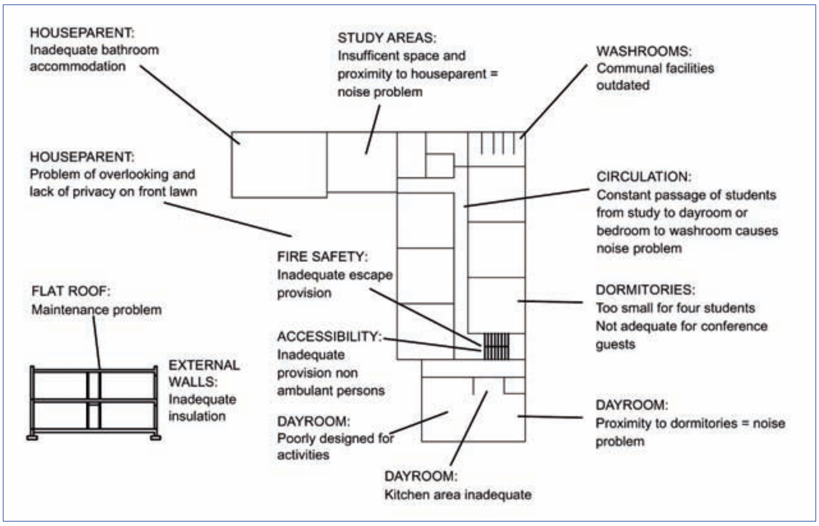
I have been interested in environmental design since qualification in 1988 and have designed buildings for other practices including schools, hotels, and urban housing projects. Some of these have been successful, but I always felt that in terms of their environmental design any degree of success depended on my gut feeling, the opinion of the services engineer, and a large dose of luck.

The ability to assess performance at a very early stage in the design process is critical to really sustainable architecture; we are at a turning point in the building industry where it will no longer be possible for the designers in the different disciplines to work independently as fully integrated design is necessary from the outset.

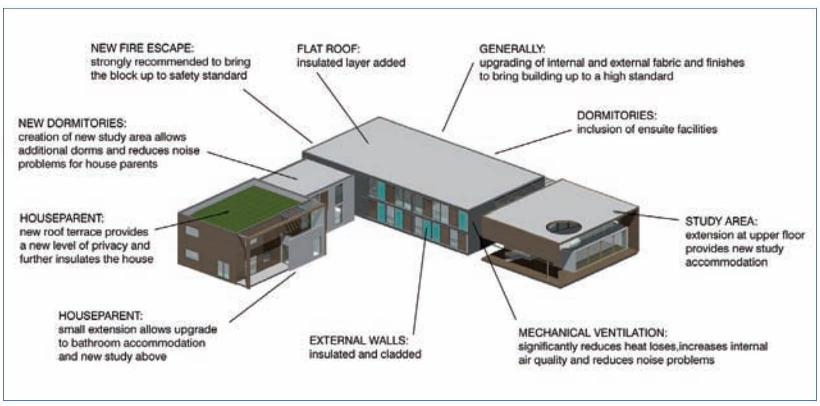
Now Graphisoft has created the link that enables an ArchiCAD BIM model to be transferred automatically into Ecotect. This means you no longer have to build in Ecotect a separate environmental analysis model from scratch, which saves a lot of time and effort. The ArchiCAD/Ecotect combination gives me the ability to do ‘quick and dirty’ sketch







Above and left: *Proposed design and strategy for refurbishment of the Atlantic College, Wales.*



Atlantic College Project in Wales.

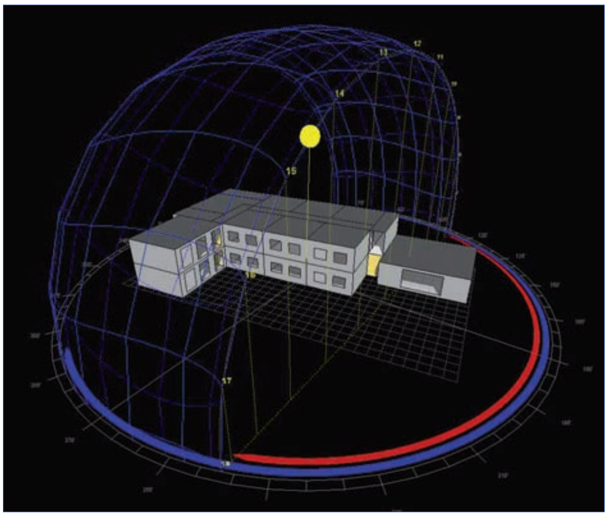
Left: *Existing building in decay.* **Above:** *Existing problems.*

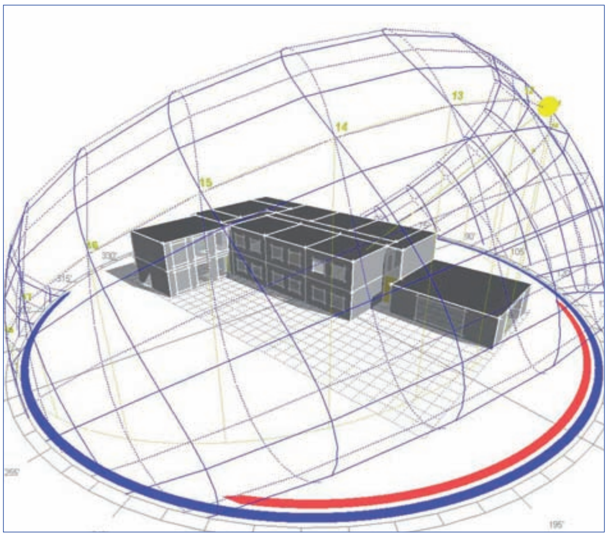
schemes, and be reasonably sure that when we come to the detail design stage we will, at the very least, be able to talk intelligently about parameters which are traditionally thought to be solely the remit of the services engineer. Hopefully we will be able to continue the process of refinement without needing to resort to major surgery or alteration of the concept.

Ecotect also gives me the opportunity to show clients, in an environmental model, how the building will perform with certain adjustments, which gives them confidence that sustainable designs can and do respond well to local conditions. The software produces a range of easily interpreted graphs and other data on a building's performance over time; really powerful tools in winning over a client's commitment to energy-efficiency.

As an example, whilst working with Atlantic College in Wales, we have been able to demonstrate, via studies completed in Ecotect, that by adopting heat pump technology alongside other low energy measures, the original 1960's student house's heat load could be reduced by up to 90%. This sort of basic analysis has enabled us to convince an understandably cautious client to commit to a quite radical building and refurbishment programme. We are hoping that we will be able to achieve at least a CSH level 4 rating on this project, making it an exemplar refurbishment scheme: an important target considering that 99% of the UK's building stock is sub standard in terms of energy use.

More recently, the analyses from Ecotect helped us win a job with the Swansea Housing Corporation; we were the only shortlisted practice with a presentation incorporating an environmental strategy for the site. We are hoping that this project will set a standard for low energy social housing in South Wales, and help to reduce fuel and water poverty for its users.





For the Atlantic College Project in Wales Gillard Associates was able to demonstrate, via studies completed in Ecotect, that by a range of low energy measures, the original 1960s student house's heat load could be reduced by up to 90%.

Using Ecotect can help practices gain a competitive edge in the expertise they can offer and in convincing existing or potential clients of their "green credentials". At its most fundamental Ecotect can provide the evidence to prevent an architect from embarking on a design that is destined to fail Part-L compliance. And, Ecotect can help an architect achieve far beyond what is required by current building regulations; which is very much my practice's ambition on all of our projects.

Alan Gillard is principal of architecture and design firm, Gillard Associates based in The Vale of Glamorgan, Wales.

www.gillardassociates.co.uk
www.graphisoft.co.uk
www.squ1.com/products/ecotect

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IES Virtual Environment

Revit goes green with the addition of the Integrated Environmental Solutions 'VE Toolkits'. Now Architects and MEP Engineers can optimise their designs without leaving the Revit environment and check against industry green standards compliance.

Green Building is undoubtedly the hottest topic in the industry today. While there's a lot of hype and folks being very earnest about saving the planet, there is a basic concept that really makes sense - know the performance characteristics of the building you have designed. In the Manufacturing world, performance is the metric that any design is first marked on; how it looks is certainly important, but secondary. Performance-based design has really lagged behind in the building world, as the tools haven't been widely available and the fractured nature meant that the optimisation and performace were really only understood, either once the design was completed, or worse, once the building was being occupied and used. At early stages in projects (sometimes as early as week three or four), 70% of the design decisions which affect performance have been made.

So, radical changes are in the pipeline and the Green/low carbon emissions initiative has focused the software developers into broadening their applications to offer the designer really useful feedback as to how fit for purpose their concept would be. No longer will analysis be something that happens at the back end of the process, it can happen at the conceptual phase and continue throughout, giving the best, 'virtually' proven design. We are at the very first part of this 'performance' revolution but it will drive practices to move to 3D-based design, as it's the only way to get meaningful analysis and architects are going to have to skill-up in some of the basic concepts of building optimization, to both run the software, or more importantly, understand the output.

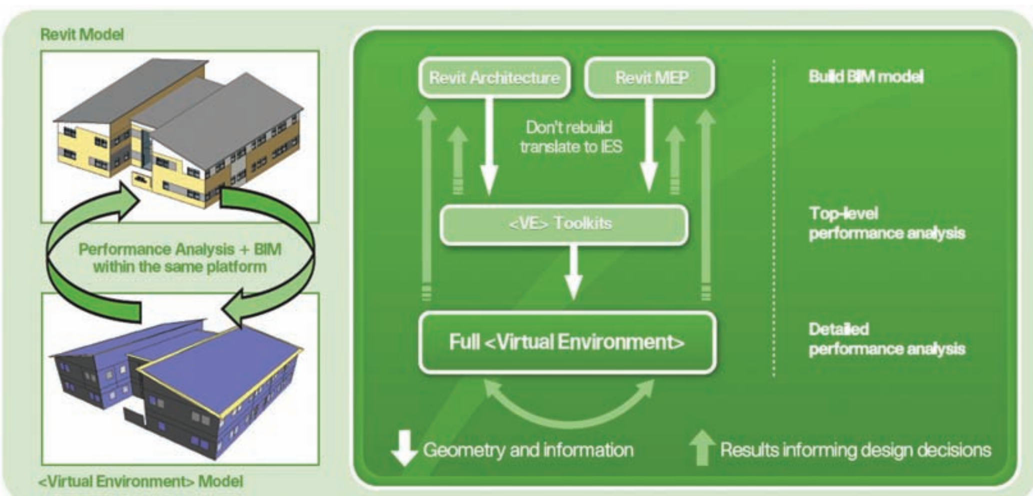
As things stand, the key 3D software tools, like Revit, ArchiCAD and Bentley Architecture don't have any of these analysis tools built-in, so additional stand-alone applications have to be bought-in. The links between the authoring tools and the analysis tools are also in a disappointingly embryonic state, however these are improving from release to release.

The two main building optimisation solutions available in the UK are Ecotect, which we looked at last month, and Integrated Environment Solutions (IES) suite named Virtual Environment (VE), which has forged close ties to Autodesk and especially with its Revit line of products. At the core of the IES solution are multiple applications which comprise the 'Virtual Environment'. Each specializes in the analysis of different criteria: Thermal, ventilation, CFD, evacuation, costs, compliance, daylighting, solar, lighting, electrical and mechanical.

IES and Revit

Revit has many advantages but the concept of the single platform means that a multi-discipline team can collaborate and work on the same design data. IES has developed a plug in for both Revit MEP and Revit Architecture, to pass the essential information for analysis in its range of specially designed, architect-oriented 'VE Toolkits'. As everything is linked together, the whole team can take an integrated approach and get timely feedback through multiple analysis cycles. The Toolkits are designed to allow architects to undertake top-level building simulation analysis, facilitating sustainable design at the click of a few buttons.

"IES has recognised that architects aren't experts at building analysis and so has really striven to boil down the results to something meaningful."



There is no need to rebuild any models for this performance analysis, integrating green-build knowledge directly into the design process, optimising the actual 3D design and minimising any structures energy consumption. Currently IES has four toolkits available for tight integration with Revit - Sustainability, LEED, BREEAM and Greenstar.

This new development enables the Revit Architecture BIM (Building Information Modelling) model to be easily imported into IES's system of integrated building performance analysis tools. Core aspects of the performance of the building can be assessed without any specialist simulation knowledge or the need to re-input geometry data. The user does not even need to leave the Revit environment.

By clicking the IES toolbar in Revit Architecture, the BIM model is transferred into IES's VE software and a dialog automatically opens. This displays the imported model and provides an easy-to-use method of assigning basic construction and room-type properties to the building and rooms as required.

VE Toolkits produce multiple reports and moves directly from Revit Architecture and give Architects a level of insight and understanding of performance that isn't available in a core package. This allows architects to make informed decisions about orientation, layout, form and construction. Furthermore, generating this performance information at the early stage of the design process makes it easier to design sustainable, low-energy buildings.

Conclusion

IES has moved from being a provider of individual high-end analysis tools, used to analyse specific building functionality, to offering a complete suite of powerful applications that function as a whole. With the decision to support Revit, IES has crossed into the third-party arena and with Autodesk and Revit, the company is certainly picking the rising star of the architectural community. IES has also recognised that architects aren't experts at analysis and so has really striven to boil down the results to something meaningful. The continued development and growth of this integration will lead to better, compliance certified designs in quicker time. I don't think that point can be argued. ***www.iesve.com***

Set in concrete

Bison Concrete leads the market in precast concrete technology and as such makes heavy demands on its printing solutions. **Amy Nicholson** finds out how Océ equipment has helped Bison to stay on top.

Some companies pride themselves on providing bespoke solutions, others prefer to be on the receiving end. Bison Concrete – a market leader in precast concrete technology and solutions to the construction business – has been at both ends of the spectrum simultaneously.

Bison gained its business edge by offering customers a bespoke service, one that begins with conceptual design, and is followed by off-site manufacture right through to the installation of the approved products on-site; £50 million has been put into a programme of investment, ensuring that Bison can continue to offer optimum service. But the company has also enjoyed a four-year partnership with Océ in which it has seen its print production overhauled and streamlined to its unique specifications.

Bison initially approached Océ to provide it with print solutions in 2002. The group was setting up a new office and was looking to replace old and unreliable plan-printing equipment. Working primarily in AutoCAD, technical drawings and documentation accounted for most of Bison's print output.

The company wanted to make their print production run more quickly, more easily and with less breakdowns. Peter Kelly, Technical Director at Bison remembers what Bison initially wanted from its print solutions: "We wanted to have a productive, high volume, reliable system that automated as much of our print production as possible. Initially we looked at hardware to print sets of drawings in collated packs that were folded so we didn't have to fold them by hand."

Bison initially leased an Océ TDS600 for its head office in Burton upon Trent and an Océ TDS400 for another of its offices, based in Falkirk. Further to this, Bison had three Océ 9300 printers to allocate to satellite offices throughout the country.

The Océ hardware soon proved its worth, leading to Bison turning its attention towards improving its document workflow: "When we saw what the Océ hardware could do, we asked Océ to extend the solution to automate our issuing and distribution process," Peter reports.

Océ was just launching a new software package, Océ Digital Distribution Manager (DDM), and Bison was clearly impressed with it and had it installed as soon as it was released. Peter was certainly happy with the solution from the word go: "We recognised that the Océ DDM represented a great solution."

Amalgamating Océ technologies made life easier for Bison, as Peter points out: "This partnership demonstrates the unique productivity of Océ's combined hardware and software to improve the issuing and distribution process, streamline our workflow and just make things a lot more efficient."





"When we saw what the Hardware could do, we asked Océ to extend the solution to automate our issuing and distribution process"

Océ DDM has been specially designed for organisations whose growth means they spend an increasing amount of time administering the distribution process rather than fulfilling their revenue-creating roles. Bison fits the bill: its portfolio has swelled to include products for retail, commercial, industrial, education and governmental sectors, and has included landmark projects like the Channel Tunnel. Bison's prodigious output certainly demands a robust solution.

As Bison grew, its equipment needed to be upgraded to cope with the expanding needs of the company. And Bison's needs were certainly evolving: the Océ TDS600 was undergoing very heavy use in Bison's main office, so it was replaced with an Océ TDS800, which was more appropriate to Bison's developing needs. It was also decided that the role of the Océ TDS400 in Falkirk would be better filled by the Océ TDS600 from the main office. These new solutions have enabled Bison to continue providing the best possible service to its clients. "The main benefit is that the equipment is printing more quickly and is still very reliable, and we are currently doing about 200,000 linear metres at Burton upon Trent," adds Peter.

Since this upgrade has been implemented, the relationship between Océ and Bison has evolved further and the new hardware, particularly the Océ TDS800, has made Bison's challenging workload manageable.

Thanks to Bison Concrete's use of the software, the Océ DDM has now gone international. Bison has appointed a team of approximately 60 designers in Vietnam and Bison has found the application to be so versatile that it benefits the work of the design team immensely.

Furthermore, Bison has found that Océ is able to provide them with more than just the large-scale print solutions a company of their size requires. Recent installations include an Océ TDS600 stand-alone scanner, as well as an Océ DS10 A4 scanner. Bison needed this equipment to help with its latest in-house project: making a digital record of their document archives. Given Bison's long history and the number of ventures it has been involved with, this constitutes a major project.

Bison has also recruited some extra staff to manage the project. This kind of work is vital to a company of Bison's size, since it needs reliable and complete archives and scanning ensures that all documentation is safely and securely backed-up for future use.

Catering to Bison's need for both large-format printing and smaller scanning equipment has led Océ's relationship with Bison to grow and develop mutually: as Bison's needs have increased, Océ's product range and capability has also expanded.

As long as this trend continues, the two companies will be able to continue supporting each other long into the future.

www.oce.com/uk

A change in the display

Rob Jamieson takes a closer look at two new display technologies and their potential impact on the design sector.

As new technology arrives there is always an initial resistance from people who invested in the old technology and don't want to think that their investment is wasted. An example of this is the move from AGP to PCI-Express - although now everybody is happy with PCI-Express as it has become the de facto standard.

Today we are on the cusp of some new changes in the graphics industry in the form of two separate technologies combining to form a new standard. These are known as Display Port and 10-bit "consumer" panels - consumer meaning affordable to the general audience as opposed to the high-end panels used in special disciplines.





Audi R8 image courtesy of Bunkspeed

Display Port

Display Port is a new form of interconnect between the graphics card and the display. It is a smaller thinner cable than DVI or VGA and, in its basic form, can be three metres long (likely to support more length in time) with the ability to drive monitors up to 9 megapixels i.e. resolutions of 2,560 x 1,600. As it's a digital interface it does not suffer from the analogue interference associated with VGA plus there is the option of chaining monitors together using one cable, allowing more data to be transferred. To get high resolution support today you need a dual link cable where all of the pins are used to send data down a DVI. Besides the aforementioned advantages, its small connection is very useful for laptops where space is limited. There is no reason why a laptop will not have a VGA port in the near future but expect them to be phased out as more projectors are built with digital inputs. Display Ports can also have a converter attached to plug into DVI/ However as it's purely digital it's harder to get a Display Port to VGA, which is why most DVI carries an analogue signal as well.

Major OEMs have announced support for Display Port monitors including Dell, which has one on its range today. The more interconnects you put on the monitor the more that the cost increases, so it's likely that if Display Port becomes popular it will end up being the only fitting on a monitor.



Dell's new 3008WFP (Widescreen Flat Panel) is one of the first monitors to feature Display Port technology..

10-bit panels

10-bit support, which allows access to more colours, has been around for a while. However, the cost of monitors has meant a slow adoption of the technology. Nonetheless it is important. Colour depth is the graduation between different colours so, for example, if you take a greyscale colour transition bar on a cheap laptop screen you can see banding where you may expect a smoother blend. This is because a lot of the cheaper laptop displays are only 6-bit, and where the graphics card may be sending 8-bit colour, the screen is only interpreting 6-bit. 10-bit displays, on the other hand, not only lessen banding but allow a greater range of transitions, meaning that you can see the difference between light and dark in greater contrast.

But what does this mean to the average CAD user? Well if your only interest is plugging a blue part into a red one without consideration for how the final design will look, then not much. However if aesthetics and colour are important then it will make a difference. Car body designers for instance are prime examples of people who will benefit from a closer representation of colour.

Some of the classical areas that will see great benefits and promote the use of 10-bit technology are in medicine where the slightest colour variation could indicate the presence of a tumour. However, areas such as photography, where it is possible to remove the dark circles from a model who has been out late the night before, is how this technology will be pushed into the mainstream. Colourists who match different TV and movie scenes shot at different times by using gentle changes in the colour temperature will also benefit from 10-bit technology, as will oil and gas companies that create massive simulations of the earth's strata to find the elusive precious minerals needed for that industry.

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Although graphic cards that support 10-bit have been around for a few years, there is a big difference between cards that can display 10-bit in 2D mode and those that can provide 3D performance and 10-bit on both outputs at the same time. Luckily for me the ATI FireGL range does this, as does the previous generation of cards.

So why aren't we using 10-bit now? The answer is that it still needs some software support that is already available in the specialist areas but that is not quite ready for mainstream consumers. 10-bit screens have also been viewed to be expensive; however there are rumours of a shift in price of monitors soon which will make more accessible to a wider audience speeding up the adoption process.

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